

SCIENCE

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; J. LE CONTE, Geology; W. M. DAVIS, Physiography; O. C. MARSH, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoölogy; S. H. SCUDDER, Entomology; N. L. BRITTON, Botany; HENRY F. OSBOEN, General Biology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; J. McKEEN CATTELL, Psychology; DANIEL G. BRINTON, J. W. POWELL, Anthropology; G. BROWN GOODE, Scientific Organization.

FRIDAY, MAY 1, 1896.

ANNUAL MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

CONTENTS:

<i>Annual Meeting of the National Academy of Sciences</i>	645
<i>Geologic Atlas of the United States</i>	647
<i>International Cloud Observations</i> : F. H. BIGELOW.....	653
<i>Notes on Native Sulphur in Texas</i> : E. A. SMITH.....	657
<i>Current Notes on Physiography</i> :—	
<i>The Adirondack Mountains and Valleys; Topographic Forms Produced by Faulting; The Baltic Sea; 'Shut-in' Valleys</i> : W. M. DAVIS.....	659
<i>Current Notes on Meteorology</i> : ROBERT DEC. WARD.....	661
<i>Current Notes on Anthropology</i> :—	
<i>Elementary Psychical Concepts; Pathology in Ethnology: The Anthropologic Study of Personality</i> : D. G. BRINTON.....	663
<i>Scientific Notes and News</i> :—	
<i>The International Catalogue of Science; Exhibition of the New York Microscopical Society; Bulletins of the Division of Entomology; General</i>	664
<i>University and Educational News</i>	667
<i>Discussion and Correspondence</i> :—	
<i>The Material and the Efficient Causes of Evolution</i> : J. McKEEN CATTELL. <i>Instinct</i> : J. MARK BALDWIN. <i>Studies in the Moral Development of Children</i> : J. F. MORSE.....	668
<i>Scientific Literature</i> :—	
<i>Scudder's Frail Children of the Air</i> : A. S. P. <i>Report of the New York State Colonization Society</i> : W. J. MCGEE.....	671
<i>Scientific Journals</i> :—	
<i>The American Journal of Science; The American Chemical Journal; The Journal of Comparative Neurology</i>	673
<i>Societies and Academies</i> :—	
<i>The New York Academy of Sciences</i> : J. F. KEMP. <i>Biological Society of Washington</i> : F. A. LUCAS. <i>The Entomological Society of Washington</i> : L. O. HOWARD. <i>New York Section of the American Chemical Society</i> : DURAND WOODMAN. <i>Harvard Geological Conference</i> : T. A. JAGGAR, JR. <i>The Academy of Science of St. Louis</i> : WILLIAM TRELEASE.....	676
<i>New Books</i>	680

THE annual meeting of the *Academy* was held in Washington on April 20, 21, 22, 23 and 25, Prof. Wolcott Gibbs, President, in the chair. The following members were present: Cleveland Abbe, Washington; Carl Barus, Providence; A. Graham Bell, Washington; John S. Billings, U. S. N.; Lewis Boss, Albany; Henry P. Bowditch, Boston; W. H. Brewer, New Haven; W. K. Brooks, Baltimore; E. D. Cope, Philadelphia; S. F. Emmons, Washington; Wolcott Gibbs, Newport; G. K. Gilbert, Washington; Theodore N. Gill, Washington; G. Brown Goode, Washington; B. A. Gould, Cambridge; Arnold Hague, Washington; Asaph Hall, Washington; C. S. Hastings, New Haven; G. W. Hill, West Nyack, N. Y.; Alpheus Hyatt, Boston; O. C. Marsh, New Haven; A. M. Mayer, Hoboken, N. J.; R. Mayo-Smith, New York; T. C. Mendenhall, Worcester, Mass.; A. A. Michelson, Chicago; E. S. Morse, Salem; J. W. Powell, Washington; F. W. Putnam, Cambridge; Ira Remsen, Baltimore; W. A. Rogers, Waterville, Me.; Ogden N. Rood, New York; H. A. Rowland, Baltimore. Charles S. Sargent, Cambridge; Charles A. Schott, Washington; Samuel H. Scudder, Cambridge; William Sellers, Philadelphia; A. E. Verrill, New Haven; Francis A. Walker, Boston; W. H. Welch, Baltimore; Charles A. White, Washington; A. W.

MSS. intended for publication and books etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

Wright, New Haven. Forty-one members were present in all, nine more than at the preceding annual meeting.

In accordance with the recommendations made at the preceding meeting, the mornings were reserved for business, and the scientific sessions were held in the afternoon, the papers being arranged so that as far as possible those upon kindred topics should follow one another. The papers entered to be read were as follows:

I. *The Geological Efficacy of Alkali Carbonate Solution*, E. W. HILGARD.

II. *On the Color Relations of Atoms, Ions and Molecules*, M. CAREY LEA.

III. *On the Characters of the Otocelidæ*, E. D. COPE.

IV. *Exhibition of a Linkage whose motion shows the Laws of Refraction of Light*, A. M. MAYER.

V. *Location in Paris of the Dwelling of Malus, in which he made the discovery of the Polarization of Light by Reflection*, A. M. MAYER.

VI. (1) *On Experiments showing that the X-Rays cannot be Polarized by passing through Herapathite.*

(2) *The Density of Herapathite.*

(3) *Formule of Transmission of the X-rays, through Glass, Tourmaline and Herapathite*, A. M. MAYER.

VII. *On the X-Rays from a Statical Current produced by a Rapidly Revolving Leather Belt*, W. A. ROGERS and FREDERICK BROWN.

VIII. *Biographical Memoir of James Edward Oliver*, G. W. HILL.

IX. *Biographical Memoir of Charles Henry Davis*, C. H. DAVIS.

X. *Biographical Memoir of George Engelmann*, C. A. WHITE.

XI. *Legislation Relating to Standards*, T. C. MENDENHALL.

XII. *On the Determination of the Coefficient of Expansion of Jessop's Steel, between the limits of 0° and 64° C., by the Interferential Method*, E. W. MORLEY and W. A. ROGERS.

XIII. *On the Separate Measurement, by the Interferential Method of the Heating Effect of Pure Radiations and of an Envelope of Heated Air*, W. A. ROGERS.

XIV. *On the Logic of Quantity*, C. S. PEIRCE.

XV. *Judgment in Sensation and Perception*, J. W. POWELL.

XVI. *The Variability in Fermenting Power of the Colon Bacillus under different Conditions*. By A. W. PECKHAM. (Presented by J. S. BILLINGS.)

XVII. *Experiments on the Reflection of the Röntgen Rays*, O. N. ROOD.

XVIII. *Notes on Röntgen Rays*, H. A. ROWLAND.

XIX. *Some studies in Chemical Equilibrium*, IRA REMSEN.

XX. *The Decomposition of Diazo-compounds by Alcohol*, IRA REMSEN.

XXI. *On Double Halides containing Organic Bases*, IRA REMSEN.

XXII. *Results of Researches of Forty Binary Stars*, T. J. J. SEE.

XXIII. *On a Remarkable New Family of Deep-sea Cephalopoda and its bearing on Molluscan Morphology*, A. E. VERRILL.

XXIV. *The Question of the Molluscan Archetype, an Archi-mollusk*, A. E. VERRILL.

XXV. *On some Points in the Morphology and Phylogeny of the Gastropoda*, A. E. VERRILL.

XXVI. *Source of X-Rays*, A. A. MICHELSON and S. W. STRATTON.

XXVII. *The Relative Permeability of Magnesium and Aluminum to the Röntgen Rays*, A. W. WRIGHT.

XXVIII. *The State of Carbo-dioxide at the Critical Temperature*, C. BARUS.

XXIX. *The Motion of a Submerged Thread of Mercury*, C. BARUS.

XXX. *On a Method of obtaining Variable Capillary Apertures of Specified Diameter*, C. BARUS.

XXXI. *On a New Type of Telescope Free from Secondary Color*, C. S. HASTINGS.

XXXII. *The Olindiadæ and other Medusæ*, W. K. BROOKS.

XXXIII. *Budding in Perophora*, W. K. BROOKS and GEORGE LEFEVRE.

XXXIV. *Anatomy of Yoldia*, W. K. BROOKS and GILMAN DREW.

XXXV. *On the Pithecanthropus Erectus from the Tertiary of Java*, O. C. MARSH.

Prof. H. P. Bowditch was elected a member of the council in the place of Prof. G. L. Goodale, who asked to be relieved from the duties of the office. Charles D. Walcott, director of the United States Geological Survey, and R. S. Woodward, Professor of Mechanics in Columbia University, were elected members of the Academy. The death was announced of Gen. Thomas L. Casey, U. S. A. There are now eighty-nine members of the Academy, eighty-three members have died since its foundation in 1863.

During the meeting of the Academy the committee appointed at the request of the Secretary of the Interior to report on a forestry policy for the government held several sessions. Members of the Academy appeared before the Senate committee having charge of the bill to fix the standard of weights and measures by the adoption of the metric system. Profs. Ira Remsen, John Trowbridge and G. J. Brush were appointed delegates to attend the sesqui-centennial celebration of Princeton Univ. A reception was given to members of the academy and invited guests by Mr. and Mrs. Arnold Hague on the evening of April 22d.

The autumn meeting of the Academy for the reading of scientific papers will be held in New York, beginning November 17th.

GEOLOGIC ATLAS OF THE UNITED STATES.
FOLIO 2, RINGGOLD, GEORGIA-TENNESSEE, 1894.

This folio consists of 3 pages of text, signed by C. Willard Hayes, geologist; a topographic sheet (scale 1 : 125,000), a

sheet of areal geology, one of economic geology, one of structure sections, and one giving columnar sections.

Geography.—The district of country covered by this folio lies mainly in Georgia, a narrow strip about a mile in width along its northern border extending into Tennessee. It embraces portions of Dade, Catoosa, Walker, Whitfield, Chattooga, Floyd and Gordon counties in Georgia, and of Madison, Hamilton and James counties in Tennessee. The region forms a part of the great Appalachian Valley. Its surface is marked by three distinct types of topography, viz.: plateaus, formed by hard rocks whose beds are nearly horizontal; sharp ridges, formed by hard rocks whose beds are steeply inclined; and level or undulating valleys, formed on soft or easily eroded rocks. The plateaus are confined to the western third of the district and include portions of Lookout and Sand Mountains. Their surface is generally level or rolling, with a slight inclination from the edges toward the center, giving the plateau the form of a shallow trough. They are bounded by steep escarpments rising from 1,000 to 1,200 feet above the surrounding valleys. The sharp ridges are confined to the eastern third of the district, while a broad undulating valley occupies its central portion. The latter is drained in part northward by tributaries of the Tennessee, and in part southward by streams flowing directly to the Gulf. The divide separating the two drainage systems is broad and low, and there is evidence that the Tennessee River formerly flowed southward across the divide.

Geology.—The rocks appearing at the surface within the Ringgold district are entirely of sedimentary origin and include representatives of all the Paleozoic groups. The oldest rocks exposed are shales, sandstones and thin-bedded limestones of lower and middle Cambrian age. These are

called the Apison shale, Rome sandstone and Conasauga shale. Above these formations is a great thickness of siliceous magnesian limestone, the Knox dolomite, the lower portion probably being Cambrian and the upper portion Silurian. The remaining Silurian formations are the Chickamauga limestone and the Rockwood sandstone. The Devonian is either wholly wanting or is represented by a single thin bed of carbonaceous shale, not over 35 feet in thickness. Above the Chattanooga black shale are the Fort Payne chert, Floyd shale and Bangor limestone forming the lower Carboniferous, and the Lookout and Walden sandstones forming the Coal Measures. Most of the formations thicken eastward, and at the same time the proportion of calcareous matter decreases, showing that the land from which the materials composing the rocks were derived lay to the east.

The region has been subjected to compression in a northwest-southeast direction, and the originally horizontal strata have been thrown into a series of long, narrow folds, whose axes extend at right angles to the direction of the compression, or northeast and southwest. The effects of compression were greatest in the eastern portion of the district, where the strata are now all steeply inclined and the basal beds form sharp ridges, while in the western portion considerable areas of strata remain nearly horizontal and form plateaus. Where the folding was greatest there was also much fracturing of the rocks, and the strata on the eastern side of a fracture are in many places thrust upward and across the broken edges of the corresponding strata on the west. Most of the ridges in the district have thrust faults of this character along their eastern bases.

Mineral resources.—These consist of coal, iron ore, mineral paint, manganese ore, limestone, building stone and brick and tile

clay. The productive coal-bearing formations, the Lookout and Walden sandstones, occupy the upper portions of Pigeon, Lookout and Sand mountains, having an area in this district of 116 square miles. The Lookout generally contains one, and in some places two or three, workable coal seams, but they are variable in position, extent and thickness. The Walden sandstone forms a considerable area on Lookout mountain, and contains at least one valuable seam of coal, which is extensively worked at the Durham mines. Two varieties of iron ore are found in workable quantities. The first is the red fossil or 'Clinton' ore, which occurs as a regularly stratified bed in the Rockwood formation, and is worked at various places along the base of Lookout mountain. The second variety is limonite, which occurs as a pocket deposit at the base of several of the ridges along the eastern border of the district. Associated with the latter, particularly along the faults, are deposits of manganese, generally as nodules scattered through the surface soil.

FOLIO 4, KINGSTON, TENNESSEE, 1894.

THIS folio consists of three and one-half pages of text, signed by C. Willard Hayes, geologist; a topographic sheet (scale 1:125,000), a sheet of areal geology, one of economic geology, one of structure sections and one giving columnar sections.

Geography.—The map is bounded by the parallels 35° 30' and 36° and the meridians 34° 30' and 35°. The district represented lies wholly within the State of Tennessee, and includes portions of Cumberland, Morgan, Roane, Rhea, Loudon, Meigs and McMinn counties. Its area is approximately 1,000 square miles, and it forms a part of the Appalachian province, being about equally divided between the valley and plateau divisions of the province. The northwestern half of the district is a portion

of the Cumberland Plateau. The surface of this half, except in the Crab Orchard mountains, is comparatively level and has an altitude of between 1,800 and 1,900 feet. Its streams flow in shallow channels until near the edge of the plateau, when they plunge into rocky gorges which form deep notches in the escarpment. The Crab Orchard mountains are formed by the uneroded portions of an anticline, the hard beds rising in the form of a low arch. Toward the southwest the hard beds were lifted higher and have been removed, exposing the easily erodible limestone beneath, and in this the Sequatchie Valley has been excavated. The southeastern half of the district lies within the great Appalachian Valley, here occupied by the Tennessee river, which flows at an altitude of about 700 feet, and above which rounded hills and ridges rise from 300 to 500 feet higher. The valley ridges have a uniform northeast-southwest trend parallel with the Cumberland escarpment, their location depending on outcrop of narrow belts of hard rocks.

Geology.—West of the Cumberland escarpment the geologic structure is very simple. The strata remain nearly horizontal, as they were originally deposited, except in the Crab Orchard mountains, where they bend upward, forming a low arch. East of the escarpment the strata have suffered intense compression, which has forced them into a great number of narrow folds whose axes extend northeast and southwest. The strata dip more steeply on one side of the arch than on the other; and, as a further effect of compression, the beds on the steeper (generally the northwestern) side have been fractured and the rocks on one side thrust upward and across the broken edges of those on the other. In this manner the folds first formed have in most cases been obliterated, and there remain narrow strips of strata separated by faults, and all dipping to the southeast.

The rocks appearing at the surface are entirely sedimentary—limestones, shales, sandstones and conglomerates—and include representatives of all the Paleozoic groups. The Cambrian formations consist of the Apison shale, Rome sandstone and Conasauga shale, a series which is calcareous at top and bottom and siliceous in the middle. The Conasauga passes upward through blue shaly limestone into the Knox dolomite, a formation about 4,000 feet in thickness, composed of siliceous or cherty magnesian limestone. Probably the lower portion is of Cambrian age, while the upper is undoubtedly Silurian. Above the dolomite is the Chickamauga limestone, whose upper portion toward the eastern side of the district changes from blue flaggy limestone to calcareous shale, and is called the Athens shale. The next formation is the Rockwood, which also changes toward the east from calcareous shale to hard, brown sandstone. These changes in the character of the rocks indicate that, while they were forming, the land from which their materials were derived lay to the southeast. The Devonian is represented in this region by a single stratum of carbonaceous shale, the Chattanooga black shale, which rests, probably with a slight unconformity, on the Rockwood. Above the Chattanooga are the Fort Payne chert and Bangor limestone of the lower Carboniferous, and the Lookout and Walden sandstones of the Coal Measures.

Mineral resources.—These consist of coal, iron ore, limestone, building stone and clay. The coal-bearing formations, the Walden and Lookout, form the surface of the greater part of the district northwest of the Cumberland escarpment, making a probably productive area of 370 square miles. The Lookout always contains one, and sometimes as many as four, beds, all of which are locally though not generally workable. The upper bed, immediately below the con-

glomerate, is the most constant. The greater part of the workable coal is contained in the Walden, the lower bed probably corresponding to the Sewanee seam farther west. This occurs in a belt 6 or 8 miles in width, along the eastern edge of the plateau. The only iron ore sufficiently abundant to be commercially important is the red fossil ore, which occurs as a regularly stratified bed in the Rockwood formation. The numerous folds east of the escarpment bring the Rockwood to the surface in long, narrow bands, along which the ore has been worked at many points. It varies in thickness from 3 to 7 feet, and, although at some places it passes into a sandy shale, it is generally a high-grade ore.

FOLIO 6, CHATTANOOGA, TENN., 1894.

This folio consists of 3 pages of text, signed by C. Willard Hayes, geologist; a topographic sheet (scale 1 : 125,000), a sheet of areal geology, one of economic geology, one of structure sections, and one giving columnar sections.

Geography.—The map is bounded by the parallels 35° and $35^{\circ} 30'$ and the meridians 85° and $85^{\circ} 30'$. The district is wholly within the State of Tennessee, embracing portions of Bledsoe, Rhea, Sequatchie, Marion, Hamilton and James counties. It lies partly in the great Appalachian Valley and partly in the plateau division of the Appalachian province. Its surface is marked by two distinct types of topography, the plateau and the valley. The former prevails in the western half of the district, which is occupied by portions of the Cumberland Plateau and Walden Ridge, the two plateaus being separated by Sequatchie Valley. The Cumberland Plateau has an altitude of about 2,100 feet, with a level or rolling surface. Walden Ridge has an altitude of 2,200 feet along its western edge, and slopes gradually eastward down to 1,700 feet. Both plateaus are bounded by ab-

rupt escarpments from 900 to 1,400 feet in height, the upper portions being generally formed by a series of cliffs. The two plateaus are separated by Sequatchie Valley, which is about 4 miles in width. Its western side, the escarpment of Cumberland Plateau, is notched by numerous deep rocky gorges, cut backward into the plateau by streams flowing from its surface; while the eastern side, the Walden escarpment, forms an unbroken wall. The eastern half of the district is occupied by the Tennessee Valley, the river itself having an altitude of between 600 and 700 feet, while rounded hills and irregular ridges rise several hundred feet higher. Leaving the broad valley, which continues southward into Alabama, the Tennessee River turns abruptly westward at Chattanooga and enters a narrow gorge through Walden Ridge. This part of its channel is very young in comparison with the valley toward the north, and there is evidence that the river has occupied its present course but a short time, having formerly flowed southward directly to the Gulf.

Geology.—The rocks appearing at the surface within the limits of the map are entirely of sedimentary origin, and include representatives of all the Paleozoic groups. The Cambrian formations include the Apison shale, Rome sandstone and Conasauga shale, a series which is calcareous at top and bottom and siliceous in the middle. The Conasauga passes upward through blue limestone into the Knox dolomite—a great thickness of siliceous magnesian limestone, the lower portion of which is probably Cambrian. Above the dolomite are Chickamauga limestone and Rockwood shale, the latter becoming brown sandstone in White Ash Mountain. The whole of the deposition which took place in this region during the Devonian is apparently represented by a stratum of shale from 10 to 25 feet in thickness—the Chattanooga black shale, which

probably rests unconformably upon the Rockwood. Above the Chattanooga are the Fort Payne chert and Bangor limestone, forming the lower Carboniferous, and the Lookout and Walden sandstones, forming the Coal Measures. Nearly all the formations exhibit an increase in thickness and in proportion of sand and mud toward the east, showing that the land from which their materials were derived lay to the east and southeast.

The geologic structure is simple in the region occupied by the plateaus, and complicated in the valleys. In the Cumberland Plateau the strata are almost perfectly horizontal, while in Walden Ridge they have a slight dip from the edges toward the center. Sequatchie Valley is located upon the westernmost of the sharp anticlines which characterize the central division of the Appalachian province. In the eastern part of the district the strata have suffered compression, which had forced the originally horizontal strata into a series of long, narrow folds whose axes extend in a northeast-southwest direction. In addition to the folding, and as a further effect of the compression which produced it, the strata have been fractured along many lines parallel with the folds, and the rocks upon one side—generally the eastern—have been thrust upward and across the broken edges of those on the other side. A fault of this character passes along the western side of the Sequatchie Valley, and several formations which would normally occur there are entirely concealed.

Mineral resources.—These consist of coal, iron ore, limestone, building stone, and brick and tile clay. The productive coal-bearing formations, the Lookout and Walden sandstones, occupy the surface of the plateaus. They have an area within the district of about 400 square miles, and contain from one to three beds of workable coal. The beds in the Lookout are generally variable in posi-

tion, extent and thickness; those in the Walden are constant over large areas, and are worked on a considerable scale at various points along the eastern side of Walden Ridge. About 200 square miles of area of these upper coals occur within the district, on the Cumberland Plateau and the eastern half of Walden Ridge. The most important iron ore in the district is the red fossil or Clinton ore, which occurs as a regularly stratified bed in the Rockwood shale. The bed is from 3 to 5 feet thick in Sequatchie Valley, but considerably thinner in the vicinity of Chattanooga and eastward.

FOLIO 8, SEWANEE, TENNESSEE, 1894.

This folio consists of nearly four pages of text, signed by Charles Willard Hayes, geologist; a topographic sheet (scale 1: 125,000), a sheet of areal geology, one of economic geology, one of structure sections, and one giving columnar sections.

Geography.—The map is bounded by the parallels 35° and 35° 30' and the meridians 85° 30' and 86°, and the territory it represents is wholly within Tennessee, embracing portions of Grundie, Sequatchie, Marion, Franklin and Coffee counties. The district lies almost wholly within the western or plateau division of the Appalachian province. Crossing its southeastern corner is the Sequatchie Valley, located upon the westernmost of the sharp folds which characterize the central or valley division of the province. The larger part of the district is occupied by the Cumberland Plateau, which has a gradual ascent toward the north, rising from an altitude of between 1,700 and 1,800 feet on the south to 1,900 or 2,000 feet on the north. The plateau is limited by a steep escarpment from 1,100 to 1,500 feet in height on the east and about 1,000 feet in height on the west. Many streams have cut their channels backward into the plateau, forming deep, narrow coves, so that the escarpment forms an extremely irregu-

lar line. Small portions of Walden Ridge and Sand Mountain appear in the extreme southeastern corner of the district, these being plateaus similar to the Cumberland Plateau farther west. A small portion of the Sequatchie Valley occupies the southeastern part of the district, with an altitude of about 600 or 700 feet, while its northwestern portion is within the 'highland rim,' a broad terrace surrounding the lowlands of middle Tennessee and separating it on the east from the Cumberland Plateau.

Geology.—The rocks appearing at the surface are of sedimentary origin, and include representatives of all the geologic periods from Silurian to Carboniferous. The Silurian formations, consisting of the Knox dolomite, Chickamauga limestone and Rockwood shale, occur only as narrow belts in the Sequatchie Valley. The same is true of the Devonian, which is represented by a single thin formation, the Chattanooga black shale. The Carboniferous formations occupy by far the larger part of the district, the Fort Payne chert and Bangor limestone forming the lower portions of the plateau escarpments and the highland rim, while the Lookout and Walden sandstones, belonging to the Coal Measures, form the summits of the plateaus.

The geologic structure of the region is in general extremely simple. The plateaus and the highland rim to the westward are underlain by nearly horizontal strata, while Sequatchie Valley is upon a sharp, narrow fold, the beds dipping downward on either side beneath the adjoining plateaus. If the rocks which have been eroded from the top of this arch were restored, there would be a ridge several thousand feet in height in place of the present valley. In addition to the folding which the strata have suffered along this line, they have been fractured, and the beds on the east have been thrust upward and across the edges of corresponding beds on the west of the fracture, so that

along the western side of the valley the formations do not appear at the surface in their normal sequence.

Mineral resources.—These consist of coal, iron ore, limestone, building and road stone and clays. The Coal Measures occupy an area within the district of about 500 square miles. Not all of this area, however, contains coal beds of workable thickness, while some portions contain two or three workable beds. The lower beds, occurring in the Lookout sandstone, are variable in horizontal position, thickness and extent, so that they can not profitably be worked on a large scale; but they have been opened at many points, and supply an excellent fuel for local use. The Sewanee seam, which is found in the Walden sandstone, from 50 to 70 feet above its base, is the most important seam in the district. It has an average thickness of 4 to 5 feet over at least 80 square miles in the higher portions of the plateau, and is extensively mined for coking at Tracy and Whitwell. The iron ore of chief importance is the red fossil or 'Clinton' ore, which occurs as a regularly stratified bed in the Rockwood shale. At Inman, in the Sequatchie Valley, it attains a thickness of 5.5 feet and is extensively mined.

FOLIO 18, SMARTSVILLE, CALIFORNIA, 1895.

This folio consists of 4 pages of text, signed by Waldemar Lindgren and H. W. Turner, geologists, and G. F. Becker, geologist in charge; a topographic sheet (scale 1:125,000), a sheet of areal geology, one of economic geology and one of structure sections.

Topography.—The district of country represented lies between the meridians 121° and 121° 30' and the parallels 39° and 39° 30', and embraces about 925 square miles, comprising a part of the foothill region of the Sierra Nevada. The elevation ranges from 50 feet above sea-level in the

northwestern corner to over 4,000 feet in the northeastern corner. The topography is characterized by a number of parallel ridges, running in a north-northwest direction. The northeastern part has more the character of an irregular and undulating table-land. Through the ridges and the plateaus the watercourses have cut deep and narrow canyons. The Yuba River with its branches drains the larger part of the district. Noncut Creek on the north and Bear River on the south are the only other streams of importance.

Geology.—Sedimentary formations occupy comparatively few areas in the district, all of which have been tentatively referred to the Calaveras formation, no fossils having been found in them. They consist of slates and quartzitic sandstones, usually with northerly strike and steep easterly dip. Diabase and porphyrite occupy large areas in the central and southern parts, as well as intrusive masses of granodiorite and gabbrodiorite. Amphibolites, resulting from the dynamo-metamorphism of diabase, gabbro and diorite, also occur in several places. The rocks of the district are principally massive, in contrast to those of the districts adjoining on the south and east. However, two lines traverse it along which extensive metamorphism has taken place and schistose rocks have been developed. The superjacent rocks, resting unconformably on the older series, consist of Neocene river gravels, together with beds of andesitic and rhyolitic tuffs. Comparatively small areas of these remain, the larger part having been carried away by erosion. Pleistocene shore gravels and alluvium occupy the southwestern corner. The Ione formation is not well exposed in this district, being in part covered by Pleistocene deposits, in part removed by erosion.

Economic Geology.—Important and rich Neocene gravel deposits in this district have been worked at Camptonville, Nevada City,

North San Juan, Badger Hill, French Corral and Smartsville. Gold-quartz veins occur scattered throughout the area, but by far most of them are found in the immediate vicinity of Nevada City and Grass Valley. These districts are among the most important of the gold-mining regions in California. Many of the rocks of the district are adapted for building purposes. The only one in extensive use is the granodiorite, near Nevada City. The often deep-red soils in the foothill region are of residuary origin. Extensive areas of alluvial and sedimentary soils are found only in the southwestern corner.

INTERNATIONAL CLOUD OBSERVATIONS.

IN a series of papers on the storm tracks and allied phenomena, prepared under the direction of the Chief of the Weather Bureau, much has been written about the cyclonic circulation at the surface of the ground, but the subject would be very incomplete without alluding to the efforts that are being made to determine the circulations of the upper atmosphere all over the globe. Theoretical solutions, to some extent confirmed by observations, have been given, and yet the true connection between the general and the cyclonic circulation has not been properly cleared up and tested by experience. So far as the general movements are concerned, the components are somewhat as follows in the northern hemisphere, those south of the equator being counterparts. Along the meridian from Lat. 24° to the equator the component is south, to the pole it is north; in middle latitude, where the extra tropical cyclones prevail, there is a northern component in the middle cloud strata, and two southern components, one near the ground and one in the cirrus strata. Along the parallels of latitude there are two systems of components; from 0° to 35° latitude, a westerly component at the surface, and an easterly

in the higher layers; from 35° to 90° latitude two easterly components, making a maximum and rapid eastward drift in the neighborhood of 54° . In the vertical, from 0° to 20° and from 70° to 90° latitude, there is an upward component; from 20° to 70° latitude, a downward component. The cyclonic and the anti-cyclonic motions to some extent spring out of these, but the really active part of them is confined to the strata within two miles of the ground, and yet the precise course of the stream lines is not comprehended throughout their extent.

Much light has been thrown upon the obscure features of these problems by observation at high altitudes, and especially by measurements of cloud heights and velocities, but still much remains to be done to reach satisfactory conclusions. It is thought that some account of these observations to be undertaken shortly, and a reference to the important literature regarding them, may be of interest to those who have these subjects at heart, especially those who are coöperating in the work of the U. S. Weather Bureau.

The attention of meteorologists, in the early developments of the subject were, naturally almost exclusively confined to studies on the data furnished by the lowest stratum of the atmosphere. The circulation and physical conditions of the air in the higher strata were investigated to some extent by means of the theoretical considerations and the general movements of clouds. It has, however, become apparent that a scientific knowledge of the action of the currents in cyclones and anti-cyclones can be obtained only by a determined attack upon the physics of the upper levels of the atmosphere. Progress in meteorology, working along the original lines at the surface of the ground, has for a number of years been disappointing, and it is well known that in the art of forecasting almost exactly the same methods that were perfected twenty years ago are still employed.

There seems to be little hope of improving this state of affairs, unless a radically new way of dealing with the data can be devised, which will efficiently supplement the system now in use.

The Chief of the Weather Bureau has expressed the opinion that there are two or three lines of investigation promising the wished-for results. One is the practical development of the knowledge already gained regarding the polar magnetic radiation from the sun. The serious difficulty in the way of doing this has been the expensive and complicated nature of first-class magnetic observatories, which must necessarily limit the number in the United States. What was wanted was a simple, inexpensive and yet reliable instrument, that could be utilized as readily as a barometer, thermometer or a watch. It seems now, after a couple years of trial, that such an apparatus is in hand, and a record of its performance will be published, with a description of it, beginning in the January number of the *Weather Review* for 1896.

Another process for getting at the action of the upper air is the transportation of barometers, thermometers and other apparatus into the higher levels. This can evidently be done by mountain stations, balloons and kites, and experiments are being conducted by the Weather Bureau to carry out this purpose as far as practicable.

A third line of investigation is the study of the clouds in all their aspects; the conditions under which the several forms are developed; the heights of the several levels, the variations of the same in the diurnal and annual periods, and particularly in connection with the cyclonic circulation of the lower strata; the direction and velocity of movement in the general circulation of the currents of the atmosphere as well as around the barometric maxima and minima. The fact that clouds are present almost every day in a series of forms which pass

from one to the other by delicate gradations, each of which must indicate specific physical properties, shows that this is a very rich field of research, which has been only imperfectly cultivated. Many interesting conclusions have been developed by observers of such phenomena in the past fifteen years, but only during the past five years has the conviction become general that this is one of the most important studies for the practical meteorologist.

With the view of reducing the details to uniformity of method, and to secure coöperation among the observers in different countries, an organization has been completed which will go into effect this spring. A brief history of the movement is as follows: The measurement of cloud heights is an old problem and many devices have been invented for the solution of the practical difficulties, of which a full account may be found in the Report of the Chief Signal Officer, Part 2, 1887, by Prof. Cleveland Abbe. More or less systematic observations, extending over considerable periods of time, have been made at Berlin, Upsala, Storlien, Kew and Blue Hill, (Mass.), by methods depending upon triangulation. Besides the simple trigonometric formulæ, another system for computing the shortest distance between the two sight lines, devised by Ekholm and Hagström, Upsala, also a process for reducing the points on a photograph plate exposed in a photogrammeter by Åkerblom, Upsala, have been successfully used and are recommended as the best known.

The following are the leading papers on cloud observations:

1. Mesures des hauteurs et des mouvements des nuages, par N. Ekholm et K. L. Hagström, Upsala, 1884.

2. Des Principales méthodes employées pour observer et mesurer les nuages, par Hildebrandsson et Hagström, Upsala, 1893.

3. De l'emploi des photogrammètres pour

mesurer la hauteur des nuages, par Åkerblom, Upsala, 1894.

4. Observations made at the Blue Hill Meteorological Observatory, *Annals Harvard College*, Vol. XXX., Part III., by H. H. Clayton and P. S. Fergusson, 1892.

At the International conference, Munich, 1891, a committee was appointed to consider the question of concerted observations on the direction of motion and the height of clouds. This committee recommended that observations on the direction of motion and the height of clouds should be commenced at certain stations distributed over the globe, and continued for one year; that short instructions be prepared for these observations; that the scheme of cloud classification put forth by M. M. Hildebrandsson and Abercromby be adopted, and a cloud atlas illustrative thereof be published.

As the result of these propositions, the coöperative international cloud observations will begin May 1, 1896, and continue one year. As far as known, the theodolite method will be employed at Washington, D. C., Blue Hill, Mass., and Christiania; the photogrammeter method at Upsala, Paris, Potsdam, Petersburg, Nijni Novgorod, Manila, Batavia, Melbourne and probably Kew, Calcutta and Sydney. The difficulty in cloud observations is to have two observers, separated by a base line nearly one mile long, set their sight lines on exactly the same point of a rapidly moving and dissolving cloud. The advantages of the theodolites is that the instruments are cheaper, many more observations can be taken with the same labor and the calculations are the briefest possible by any method. The observations that must be rejected at the outset can be determined by a small plotting machine, being a model of the real base line and instruments, such as invented by H. H. Clayton, at Blue Hill. Photographs, on the other hand, possess the advantages of giving definitely the point on the cloud, but the

difficulty of securing photographs of all kinds of clouds in all weather is very great, and the cost of the work much more for the same number of individual observations. The international classification of cloud forms has been issued, and it will be adopted by the Weather Bureau and go into operation July 1, 1896, throughout the service. Suitable instructions and illustrative forms have been prepared for the observers, with which they are to become familiar before the date mentioned. The atlas of cloud forms issued by the Committee is now ready for distribution, and may be purchased of M. Teisserenc de Bort, Bureau Central Meteorologique, 176, rue de l'Universite, Paris, France.

Besides the observations with theodolites and photogrameters for the actual heights and velocity of motion of clouds at the primary stations, a number of secondary stations for the relative motions, and the other available data, will be established in each country. In the United States there will probably be ten such stations under the immediate control of the Weather Bureau, equipped with nephoscopes for the observations. It is very desirable that the network of the stations be made as complete as possible in all parts of the country, and it is hoped that this opportunity for co-operation may be embraced by other persons willing to do some valuable scientific work. The colleges might profitably instruct their students in such observations at a very moderate expense. A first-class nephoscope can be made for twenty dollars, and serviceable ones at lower rates. The observations would require half an hour's work three times a day, between 8-9 a. m., 1-2 p. m., 5-6 p. m. The Weather Bureau will furnish suitable instructions to observers, and will aid them as far as possible in explaining the very simple computations that would be needed to prepare the observations for final discussion.

There are many forms of nephoscopes in use, but the one devised by Prof. Marvin, of the Weather Bureau, seems to be especially well adapted to the requirements. A description of it will be found in the January number of the *Weather Review*. It may be said in this place that its best feature is the device for keeping the sighting knob exactly twelve centimeters above the mirror in every possible position, so that the unit of height becomes 1000 meters, and the velocity in meters per second at that height is just one third the number of millimeters passed over by the image in 25 seconds. This makes the computations very easy, and when the height of the cloud level is known from the theodolite work, the actual velocity is obtained by simply identifying the cloud observed from its form as belonging to such a level. The mean of a large number of observations gives a true velocity. The base line at Washington is about 1360 meters long, one end on the Weather Bureau building, and the other on the War, State and Navy building. The ratios of velocity by the theodolites and nephoscopes at this station, in the different cloud levels, gives the means of using other nephoscope observations, provided the naming of the cloud forms is carefully done.

The ultimate problem is to obtain the coördinate velocities of the several components in the general circulation, and the relation that these have to the cyclonic circulations which depend upon them. The importance of these solutions to the art of forecasting, and the fact that voluntary observations made in widely separated parts of the United States are needed as contributions to the network, together with the simplicity that pertains to nephoscope work, induces the hope that some interested in the physics of the air may take up the task of coöperation.

FRANK H. BIGELOW.

WASHINGTON, D. C.

NOTES ON NATIVE SULPHUR IN TEXAS.

ABOUT 40 miles northwest of Pecos City, and 20 west of Guadalupe station on the Pecos Valley Railroad, are some deposits of sulphur, a short account of which may be of interest to the readers of SCIENCE.

These deposits occur in the 'Toyah Basin' (or its extension), referred to by Prof. R. T. Hill in his report on the Artesian waters of Texas. This basin is one of a series of lacustrine formations occupying valleys eroded in the plains or enclosed by mountain blocks, the underlying and enclosing formations being the Red Beds and the lower strata of the Comanche series of the Texas geologists.

To the northwestward of Guadalupe station, and distant some fifty or sixty miles, the Guadalupe mountains (of Paleozoic rocks) end with a perpendicular escarpment of at least a thousand feet in height, forming a conspicuous as well as a most beautiful feature of the landscape. Twenty-five or thirty miles west of the station a range of hills two to five hundred feet in height, with increasing altitude towards the west, and composed of the yellowish calcareous sandy rocks, probably of the Comanche horizon, makes the first interruption to the monotony of the plain in this direction. From the station out to these mountains and hills, and to the southwestward, beyond the limits of vision, the country is in general terms a level plain; in detail, a succession of low ridges and shallow ravines or 'draws,' the result of the erosion of the original plain. The region is practically destitute of trees, but there is on the elevations a scanty growth of yucca, dwarf mesquite, cactus and similar desert plants, to which in the lower and moister places there is added a dense growth of grasses, and in places a few stunted cedars.

The shallower ravines expose only the materials of the basin formation, coarse sand loosely cemented by lime; silt, usually

pinkish or light chocolate brown in color, water-worn siliceous pebbles; and 'tierra blanca,' a white chalky calcareous material possessing some hydraulic properties (Hill). In the deeper ravines erosion has laid bare the underlying formations, which are, according to locality, the red or dark purple clayey materials of the Red Beds or the sandy yellowish limestones of the Comanche. In these deeper 'draws' are a few springs of gypseous water which flow off in rather bold streams, to be speedily absorbed by the porous soils. Two of these, the Screw Bean and the Maverick springs, are between the station and the sulphur deposits. Besides these there are several springs whose waters are strongly impregnated with sulphur, and where the pools of water stand for some time they become briny, leaving, upon evaporation, a thick crust of salt. The level country between the limestone hills above mentioned possesses somewhat similar characters, and in the plain enclosed by these hills there is a fine spring of slightly gypseous water some five miles to the westward of the farthest of the sulphur localities. This is at the Tierman ranch where the water has been used to some extent in irrigation around the ranch.

At the three places visited by me the sulphur was found below bare, apparently wind-swept, spots, its presence being usually indicated either by clusters of gypsum crystals in the soil, or by an outcrop of the sulphur itself, sometimes tolerably pure, sometimes cementing the surface pebbles into a conglomerate. When further exposed by pits, the sulphur is seen to occur in nests and irregular veins filling small fissures or crevices in the soil, the sides of these fissures being often lined with well-developed sulphur crystals up to one-fourth of an inch in size. The whole of the earth, to the depth of ten feet or more at the three localities visited, appeared to be im-

pregnated with sulphur, sometimes almost imperceptible to the eye, but oftener in minute crystals concentrated along irregular lines. Where thus generally disseminated through the brown or chocolate-colored earth, the sulphur makes some 10 or 15 per cent. of the whole weight, but where concentrated along the lines above mentioned the percentage of sulphur goes up to 40 or 50 and even higher, for not infrequent is the occurrence of sulphur in the massive form, very light yellow in color, opaque, and of earthy aspect, resembling a yellowish meerschaum, but of exceptional purity, several analyses of average samples showing 97 per cent. sulphur. The average content of sulphur in the material penetrated by the several pits which were examined by me could not be far short of 50 per cent.

In the immediate vicinity of one of the occurrences the surface soil is highly charged with gypsum, which appears in small crystals and in large groups of crystals imbedded in the white calcareous sandy material rendered strongly acid by the decomposition products of the sulphur. At one place the sulphur beds rest upon an impure limestone which has been so greatly corroded by these acids as to be very difficult of identification.

Upon exposure to the air the sulphur rapidly undergoes alteration, being in great part finally converted into sulphuric acid, but becoming first opaque and soapy. From this cause the heaps of nearly pure sulphur piled around the mouths of the prospecting pits, rapidly disintegrate and disappear. In many cases, however, this waste has been partly due to the mechanical action of floods which, by reason of the occasional heavy rainfalls, sweep down the generally dry 'draws,' carrying everything before them. The sides of the pits and the materials thrown out of them exhale a peculiar odor (sulphury), and are so strongly acid as to destroy quickly the clothing and other

organic matters brought in contact therewith.

The sulphur beds do not appear to underlie uniformly the whole basin, for in the region indicated, within a radius of twenty miles, only three places are as yet known where they occur. The actual outcrop by natural or artificial exposure will here cover some four or five acres, but the probability is that the sulphur in each of the localities underlies a much larger area, for wherever penetrated by borings or pits the sulphur-impregnated earth has been encountered to a depth of at least ten feet, and a deposit of this thickness could hardly be conceived to thin down so rapidly as to limit the occurrence of the sulphur to the small area in which it has actually been exposed.

Nor, on the other hand, are the sulphur deposits of Texas confined to the particular region designated in these notes, for there are well authenticated reports of their occurrence both to the westward and to the northward, the former from cowboys, through whose representations attention was first directed to the beds above described, the latter upon the authority of Capt. John Pope, who had charge of one of the divisions of the survey of the railroad routes to the Pacific. Along the banks of Delaware creek he collected a sample of earth which contained 18.28% of sulphur, and he comments also upon the frequency of sulphur springs in the same region. Delaware creek rises among the Guadalupe mountains and flows into the Pecos river some fifty miles to the northward of Guadalupe station.

The materials filling the basins of the Trans-Pecos region have very generally been considered as of lacustrine origin, and of the truth of this supposition we have very good proof in the great number of fresh-water diatoms discovered in the sulphur-impregnated earth submitted by me to Mr. K. M. Cunningham, of Mobile, for

microscopic examination. The basin formation is considered by Mr. Hill to be of Pleistocene age, but somewhat more recent than the Llano Estacado.

In regard to the origin of the Texas sulphur beds, the most significant of the associated materials are the beds of gypsum which a few miles to the northeast are of commercial importance because of their great thickness and purity; the springs of sulphur water which are abundant along all the deeper drainage ways; and the ancient lake deposits which practically make the country. These deposits contain much organic matter along with calcareous and siliceous sediments.

The sulphur deposits of Sicily have probably received more careful study than any others, and they are generally thought to be derived from springs charged with calcium sulphide or sulphuretted hydrogen and carbonate of lime, resulting from the decomposition of gypsum in presence of organic matter. The decomposition products of the sulphur, in turn, acting upon calcareous matters, yield gypsum, thus completing the cycle.

Without enquiring into the origin of the great gypsum deposits of this section, I think we must consider the sulphur as one of its products, though due more immediately to the oxidation of sulphuretted hydrogen.

If these deposits were more accessible there could be no question as to their commercial importance. They are twenty miles from railroad lines, and in a country destitute of fuel and with scanty supply of surface waters. On the other hand, there would be no difficulty in the way of constructing a railroad or tramroad, which could be built out to the sulphur beds almost without grading, and that a supply of water could be had by artesian borings is as good as certain, for further down the basin near Pecos City abundance of water is obtained from

borings of 200 to 300 feet. The nearest source of fuel would probably be the Texas coal fields.

EUGENE A. SMITH.

UNIVERSITY OF ALABAMA.

CURRENT NOTES ON PHYSIOGRAPHY.

THE ADIRONDACK MOUNTAINS AND VALLEYS.

A FEW pages in the account of Essex county, N. Y., by Kemp (Rept. State Geol., N. Y., 1893, 438-441) describe the Adirondack ridges thereabouts as trending to the northeast, Lake Champlain rounding their ends in a series of bays. The longitudinal valleys are said to be chiefly due to faults, and the mountains are regarded as of the tilted-block type; the evidence of the faults being found in breccias and shear zones (as of Avalanche lake, Amer. Journ. Sci., Aug., 1892), and in the narrow 'passes' which are said to be evidently produced by fault scarps. Moreover, the ridges are commonly abrupt on one side and slope more gradually on the other, as in Knob mountain. A later report by the same author states that the relief of the region is not caused entirely by erosion, but that it is 'in a large part due to block faulting' (Bull. N. Y. State Museum, III., 1895, 328). It is further concluded that many of the valleys must have been outlined in pre-Cambrian times; for small areas of Potsdam sandstone occur in the depressions far within the mountains.

TOPOGRAPHIC FORMS PRODUCED BY FAULTING.

THE context of the above extracts seems to indicate that their author infers an ancient date for the faults mentioned, and a considerable amount of erosion subsequently in the excavation of the valleys; yet the hasty reader might gather the idea that the forms now visible were directly initiated by faulting of comparatively recent date. It is not decidedly stated whether the faults lately produced the ex-

isting relief, or whether the fault lines, as lines of weakness, have been eroded down into valleys, or whether the valleys have been lately (*i. e.*, in Tertiary time) eroded out of weak masses of rock that were long ago brought by faulting next to hard masses, or whether the valleys have lately been re-excavated in the Paleozoic rock-filling of ancient fault-block valleys; nor is the date of the faults explicitly stated. Here, as in many other cases, it is probably difficult to choose among these alternatives. Type examples of the various relations of form to faulting are, however, well known. Monoclinical ridges of strong relief, initiated by faulting and as yet hardly affected by erosion, are found in the tilted lava blocks of southern Oregon, described by Russell. The ranges of the Great basin are thought to be older fault blocks, more or less altered by erosion; but it is difficult to determine from the published descriptions by various observers all the elements of the problem; namely, the form that the region had before faulting, the form given by faulting (distinction being made between the uplifted back slope and the broken face of the faulted and tilted blocks), and finally the forms produced by erosion after faulting. Our Appalachian region offers plentiful examples of the complete extinction of the unequal relief initiated by ancient faults, as well as many other examples of notches and valleys whose erosion, in a new cycle after peneplanation, has been guided by fault lines or by the weaker parts of ancient faulted structures.

The well proved geological occurrence of a fault has been often taken as a sufficient explanation of form, without the aid of erosion. For example, Kjerulf regarded faults as the cause of the valleys and fiords of Norway; but it is probable that the faults there are for the most part of ancient date, while the valleys can hardly be older than Tertiary times. The zigzag escarp-

ments of the crystalline uplands east of Lake Vettern, in Sweden, imitate to perfection the forms that might be produced by recent faulting (see sheets 55, 56 of the Swedish topographical survey). Faults are numerous in the region, but it is probable that the inequalities here due to faulting were long ago worn out in the general denudation that produced the upland (once a lowland peneplain) of Scandinavia; and that the escarpments now visible were produced, after a general uplift of the region not longer ago than somewhere in Tertiary time, by the erosion of the weaker Paleozoic beds that had much earlier been faulted down next to the crystallines. How all this may be in the Adirondack region will perhaps be more fully determined by further observation.

THE BALTIC SEA.

PROF. RUDOLPH CREDNER, of the University of Greifswald, whose monograph on Rügen (*Forschungen z. deut. Landeskunde*, vii., 1893, 377-494) gives an interesting account of the interglacial deformation of that island, now extends his studies to the origin of the depression in which the Baltic lies. Placed between the oldland of Scandinavia and the younger deposits of the North German plain, the minor depressions contained within the general basin are ascribed to local faulting, more or less modified by later denudation, especially by glacial action. The observed faults on either side of the Baltic are taken to indicate that other faults occur beneath the waters of the sea. The outlines of the present shore result from broad oscillations of level, whereby the area of the sea has been significantly altered in comparatively recent times (*Hettner's Geogr. Zeitschr.*, i., 1895, 537-556).

The analogy, pointed out by Suess and others, between the Baltic and our Great Lakes appears to deserve greater emphasis

than is given to it by Credner. The Baltic and the lakes lie, as a whole, between an oldland and a series of less ancient strata, dipping away from it. The Gulf of Bothnia and Lake Superior are both within the limits of the oldland; the other basins are along the margin. In our Great Lakes, local faulting has not been noticed. As for the Swedish faults, most of them are too ancient to have any effect on existing topography, except as guides for modern erosive forces. Warping of a longitudinal depression, originally produced by ordinary denudation and modified by glacial erosion and deposition, appears to deserve greater importance than Credner allows it.

'SHUT-IN' VALLEYS.

THE St. François mountains of south-eastern Missouri consist of very ancient rock masses that have been more or less completely buried in Paleozoic strata, and that are now partly resurrected by the stripping of their cover. An expected feature of such mountains is the occasional occurrence of narrow superposed valleys, either still occupied or now deserted by their streams. A typical example of the latter kind is found in the notch that holds Devil's lake in the Baraboo ridge of Wisconsin, explained by the Geological Survey of that State as the former superposed course of the Wisconsin river. A report by Keyes on the Mine la Motte sheet of the Missouri geological atlas now announces the occurrence of several narrow valleys of this class still occupied as water courses, and so unlike the broader valleys up and down stream that they are locally known as 'shut-ins.' A good example is found two miles west of Fredericktown, where the Little François river passes through a narrow gorge in the porphyry mass of Buckner and Devon mountains between open limestone valleys up and down stream. Discordance of drainage with their sur-

roundings, as well as of structure, form and products, thus seems to characterize resurrected ancient mountains. Monadnocks, on the other hand, may be said never to be traversed by streams. W. M. DAVIS.

HARVARD UNIVERSITY.

CURRENT NOTES IN METEOROLOGY.

UNDER the heading Current Notes in Meteorology it is intended to publish, from week to week, or as opportunity may offer, short notes on recent publications of general interest and of importance in meteorology and climatology. Meteorology, although one of the newest of the sciences, is growing in importance every day, and its literature is rapidly increasing. To-day every scientific man needs some knowledge of what this literature is. Unfortunately, since the suspension of the *American Meteorological Journal*, in April of this year, there exists no representative independent meteorological publication in the United States. There is, therefore, at present no American journal to which one may turn for information regarding recent meteorological literature. It is the main purpose of these notes to supply this need, and to give the titles, together with a few words as to the contents, of such publications in meteorology and climatology as seem to warrant notice in a general scientific journal such as this is. Mention will also be made of meteorological phenomena of interest, accounts of which appear from time to time in records of travel, the *Monthly Weather Review* of our Weather Bureau, the bulletins of the various State Climate and Crop Services, etc. In this way it is hoped to furnish, in this column, a source of information on general meteorological and climatological matters that is at present lacking in the United States.

MAY 1st was the date set for the beginning of the International Cloud Year, in accordance with a resolution adopted by the

International Meteorological Committee at its meeting in Upsala in August, 1894. Nine countries have promised to coöperate in the work, which includes determinations of the altitudes, directions and relative velocities of clouds. These countries are as follows: Batavia, France, Norway, Portugal, Prussia, Roumania, Russia, Sweden and the United States. One or two stations in each country are to furnish observations of altitudes, determined by means of theodolites or photogrammeters, while at certain auxiliary stations records of direction and relative velocity will be kept. In the United States, the chief office of the Weather Bureau, in Washington, and the Blue Hill Observatory, in Readville, Mass., will determine altitudes, while the observations of direction and velocity will be made at Washington, New York, Buffalo and Detroit. The records collected during the year will certainly throw much light on certain much-debated questions of cloud movements and of cyclonic action.

ARTIFICIAL tornado clouds have recently been produced by Dines in England (*Quart. Jorun. Roy. Met. Soc.*, Jan., 1896, 71-73). The apparatus used was a simple one. Two glass screens, 2 ft. high, each consisting of three leaves, were set upon a table so as to leave a hexagonal space in the middle. On top of the glass plates a wooden panel of the requisite size was placed, with a round hole 7 in. in diameter in the center. In the hole there was a ventilating fan, driven by hand, and in the center of the table, between the screens, a shallow vessel containing water was placed, heated by a spirit lamp, in order that sufficient vapor might be obtained to form the funnel cloud. When the fan is turned on in this apparatus an upward current of air is produced at the center, and a cloud is formed. This cloud has a distinct rotary motion around the center, increasing in velocity as the

center is approached. There is further a strong updraft, a great decrease of pressure in the center, and the cloud column is distinctly hollow, in all these respects closely simulating the actual tornado funnel cloud. The conditions of the experiment are, however, so unlike those existing in nature during the occurrence of tornadoes that, although interesting, the results cannot be considered as very important.

ATTENTION has lately been again directed to the matter of Arctic Exploration by reasons of the rumors as to Nansen's voyage, and the frequent allusions, in scientific papers, to Andrée's balloon expedition, which is to start this summer. The recent publication of Gen. Greely's *Handbook of Arctic Discoveries* (Boston, Roberts Bros., 1896) is therefore very timely. Gen. Greely, as is generally known, led the United States expedition sent out in 1881 to take part in the system of international meteorological observations planned by the International Meteorological Conference and the International Polar Conference in 1879. Fifteen expeditions were sent out as a result of this plan, and they together made up the line of International Circumpolar Stations, whose work has been of such great importance in meteorology. Gen. Greely gives a general account of Arctic discoveries, and devotes one chapter to the International Circumpolar Stations.

A NOTE on a rather unusual meteorological phenomenon appears in the February Bulletin of the New England Section of the Climate and Crop Service. On February 19th, on the campus of Trinity College, Hartford, Conn., a southerly wind, blowing over a thin covering of damp snow, caught up little pellets of this snow and, rolling them over and over, made them into muffs or 'rollers.' These 'rollers' increased in diameter as they were driven on by the wind, until some of them measured 8 inches

in diameter and 8 inches in length. The cylinders had conical depressions at each end, these depressions nearly meeting at the center. Similar 'rollers' were observed in Connecticut on February 20, 1883, on which day some of them measured 12 x 18 inches, and their paths could be traced for 20 or 30 feet in the snow.

R. DE C. WARD.

HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

ELEMENTARY PSYCHICAL CONCEPTS.

THE eminent anthropologist, whom his disciples love to call the 'Altmeister' of the science, Dr. Adolf Bastian, has added another to his numerous works by one recently published in Berlin (Weidmannsche Buchhandlung), entitled 'Ethnische Elementargedanken in der Lehre vom Menschen.' These elementary or rather elemental thoughts may be looked upon "as the germinal matter out of which proceeded the psychical growth of the ethnic organism in its various methods of mental or spiritual expression," as the author states in his preface.

The subjects treated are those opinions which primitive peoples had and have on the topics relating to the ultra- or supernatural world, and its relations to man; such as divinity, the under-world, guardian spirits, mysteries, names, prayer, sacrifice, prophecy, heaven, hell, fate, evil, good, the creation, miracles, femininity, vows, witches, immortality, and a host of similar notions, which the author treats with his usual astonishing, overflowing and overwhelming erudition, and with that complexity of style which simply appals a foreign reader. Anyone who wishes a 'hard lesson' in German should take up the author's introduction to his second part.

PATHOLOGY IN ETHNOLOGY.

ONE of the most enlightened German writers on ethnology, Dr. Thomas Achelis, makes the following remark in an article in

Globus, No. 4, 1896: "Every form of degeneration, since it is a pathological process, does not belong primarily to subjects of ethnologic study." He would grant the first place only to subjects which reveal organic development, progressive evolution, and lift to higher phases of culture.

This seems a serious error. It is the duty of the ethnologist, as of every other scientist, to study things as they are, awarding to each an equal amount of attention. What appear to be degenerations are often necessary steps in life process. Important advances in physiology have frequently been gained by the study of pathology. Science is untrue to itself when it undertakes to make the defense of evolution its chief aim. It should seek exact truth, indifferent as to whether that makes for goodness or for badness, as we judge those norms. "What seems most against nature, is yet natural," said Goethe; and whatever is natural, whatever is real, in other words, should claim our consideration, independently of its imagined tendencies; and nowhere is this more essential than in ethnology.

THE ANTHROPOLOGIC STUDY OF PERSONALITY.

THE word *persona* originally meant the mask which actors wore on the scenic stage; and a cynic would say that personality often means the same to-day. Strictly, we may use it as a synonym of individual self-consciousness, or the knowledge of self as a subject. In previous ages it was studied exclusively by introverted mental observation, and this led to vague speculations on the "Ego," of small positive worth.

In the '*Revue Scientifique*,' January 25th, Prof. Pierre Janet, of the College de France, lays down the principles for the anthropologic study of this phenomenon of personality. In itself it is to be regarded as the synthesis of the conscious and unconscious mental experiences of the individ-

ual, and it is to be defined and investigated by these methods: 1. The examination of self as heretofore carried on. 2. The examination of allied phenomena in the healthy condition of other minds, bringing them into comparison with our own; and, 3. The examination of minds more or less diseased in the direction of their personality. He lays especial stress on the last mentioned, referring to cases where the sense of personality has been partly or wholly lost. The problems of unconscious cerebration, subliminal consciousness, and the like, must also receive due attention.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

SCIENTIFIC NOTES AND NEWS.

THE INTERNATIONAL CATALOGUE OF SCIENCE.

THE International Conference to consider the preparation of a catalogue of scientific literature by international coöperation will be held at the rooms of the Royal Society, London, beginning on Tuesday, July 14th.

The committee of the Royal Society suggests provisionally that the author and subject catalogue shall be restricted in the first instance to branches of pure science, such as mathematics, astronomy, physics, chemistry, geology, zoölogy, botany, physiology and anthropology, to the exclusion of applied science, such as engineering, medicine and the like, but that all definite contributions to pure science shall be thoroughly indexed, whether occurring in books, memoirs, etc., treating of pure science or in those devoted to applied or practical science.

The committee also recommends that there shall be a first issue of authors' titles, subject-matter, etc., in the form of slips or cards, which shall be distributed as speedily and as frequently as possible to subscribers, and that a further issue in book form shall take place at such intervals as shall be determined on, parts corresponding to the several sciences, being, if found desirable, published separately.

It is recommended that a central bureau shall be established under the control of an international council having authority over any under-

taking which may be allotted to particular countries, institutions or persons. The cost of the catalogue, in so far as it is not met by sales, should be provided for by means of a guarantee fund subscribed by governments, learned societies, institutions and individuals throughout the world, and it is estimated that the annual sum thus to be secured should be approximately \$50,000.

The conference will have to take into consideration where the bureau shall be placed, how the international council shall be appointed and organized, what language or languages shall be used and what system of classification shall be adopted. It is suggested that the decimal system of Dewey may be so amended as to be worthy of adoption.

As already stated in this journal, the delegates to the conference from the United States are Dr. John S. Billings and Prof. Simon Newcomb.

EXHIBITION OF THE NEW YORK MICROSCOPICAL SOCIETY.

THE Seventeenth Annual Exhibition of the New York Microscopical Society took place at the American Museum of Natural History on Tuesday evening, April 14th. The attendance steadily increasing from year to year has been a true indication of the value of this exhibition in what is usually spoken of as 'popularizing science.' The indiscriminate study of natural science often works more harm than good, especially if it be acquired through desultory and misdirected reading. Personal observation insures the safest and most lasting knowledge of Nature's acts and works. If this principle has been inculcated into the non-scientific portion of the audience, one purpose of the exhibition will have been accomplished. Persons more directly concerned and interested in scientific work also found enough to attract their attention.

The catalogue of seventy exhibits included many specimens of chemical crystals and minerals; various forms of pond life; the mouth parts of several insects, with specimens of their destructive borings in wood and other substances; drug plants and preparations of these; microscopical tests for the detection of quinine,

morphine and various poisons; the methods of studying bacteria, with complete set of cultures, apparatus, etc.; photomicrographs and preparations illustrating the structure of steel, and many other objects of interest.

At nine o'clock Dr. Edward G. Love, the President of the Society, gave a brief lecture on the use of the microscope in the examination of the fibers of various textile fabrics, fully illustrated by lantern slides. The committee of arrangements consisted of Messrs. George W. Kosmak, George H. Blake and William B. Tutthill. It seems no more than right and proper to acknowledge at this point the obligations which this and other scientific societies of New York should feel towards the Museum authorities for the many courtesies and favors shown.

G. W. K.

BULLETINS OF THE DIVISION OF ENTOMOLOGY.

As previously announced in these columns, with the interruption of *Insect Life*, the periodical bulletin of the Division of Entomology, U. S. Department of Agriculture, the publication of two series of bulletins was begun, the first a technical series, embodying the results of the purely scientific work of the members of the force of the Division, the second a general series of economic bearing. Of the first series two numbers have been published, the first, A Revision of the Aphelininæ of North America, by L. O. Howard, and the second, The Grass and Grain Joint-worm Flies and their Allies; a Consideration of Some North American Phytophagic Eurytominae, by the same writer. The last named publication has just appeared. It embodies descriptions of nineteen species of plant-feeding Eurytominae, fourteen of which are new. All of the species make galls in the stems of graminaceous plants, with the exception of two which feed in the seeds of Vitis. Mr. Howard rehabilitates, on structural grounds, the colorational species of *Isosoma*, established by Fitch, and decides that the species which Fitch considered to be *Isosoma hordei* is entirely distinct from Harris' species, and that the latter corresponds with Fitch's *Isosoma fulvipes*.

The general series of bulletins so far issued includes No. 1, The Honey Bee; a Manual of

Instruction in Apiculture, by Frank Benton; No. 2, Proceedings of the Seventh Annual Meeting of the Association of Economic Entomologists; and No. 3, The San José Scale: its Occurrences in the United States, with a full account of its Life History and the Remedies to be used against it, by L. O. Howard and C. L. Marlatt. The last-named is a pamphlet of 80 pages and includes a very full illustrated account of *Aspidiotus perniciosus*, particularly in regard to its eastern occurrences; the life history of the species as determined by careful indoor experiments at Washington; and a complete bibliography.

GENERAL.

THE sub-committee of the New York Legislature has reported to the Assembly recommending that the State Geological Survey be placed entirely under the management and direction of Dr. James Hall.

THE Council of the Royal College of Surgeons, England, has awarded the Jackson prize to Dr. A. A. Kanthack for an essay on tetanus, and the Walker prize, for the best work on cancer, to Mr. H. J. Stiles.

THE United States civil service commission will hold an examination in Washington and other cities, commencing at 9 a. m. on May 15, to fill two vacancies in the position of scientific assistant in the fish commission, the salary of one position being \$720 per annum and of the other \$1,200 per annum.

WE learn from *Nature* that a memorial has been projected in Germany to the late Prof. Hermann Hellriegel, of Bernburg, who died in September last. It is proposed to erect a monument in the churchyard at Bernburg, where the remains of the distinguished investigator are interred. An appeal for contributions has been issued, and a small committee, consisting of the President and Secretary of the Bernburg Agricultural Society and Dr. Wilfarth, Hellriegel's colleague in his researches, has been formed to carry out the details.

SENATOR CANNON, of Utah, has introduced into the Senate a joint resolution proposing the construction at Washington of a map of the United States on a scale of one foot to the mile.

It is stated that Sir Wollaston Franks, who has been an officer of the British Museum since 1851, will shortly retire from the head of the department of British and Mediæval Antiquities.

A CABLE despatch states that the Governor of Yakutsk reports officially that the inhabitants of Ust-Yansk have not heard anything about Dr. Nansen, the Arctic explorer, who was recently reported to be returning after having discovered the North Pole.

A VITASCOPE devised by Edison, and similar to the kinoscope of MM. Lumière (see SCIENCE N. S., No. 66, p. 513), has been exhibited in a New York theater and received with much applause. A scene showing surf beating against a pier and breaking on the sand is said to have been especially successful.

THE most interesting announcement in the report of Sir A. Geikie on the Geological Survey of the United Kingdom for 1895 concerns the new general map of England and Wales on a scale of four miles to an inch. Of the total thirteen sheets, seven have been issued, five are in the hands of the engraver, and the remaining one will be shortly prepared. Experiment has been made on one of these sheets as to the comparative cost of hand coloring and color-printing; the price by the first method being 10s.6d.; by the second, 2s.6d. So far as can be judged at present, the sale justifies the expectation that the color-printing system may be continued and extended. Not only is there the advantage of a much lower price, but far greater accuracy of the maps can be insured than when each copy has to be laboriously copied by hand.

AT a meeting of the Royal Meteorological Society of London, on April 15th, Mr. E. D. Fridlander, gave an account of some observations of the amount of dust in the atmosphere made at various places during a voyage round the world in 1894-5. The experiments, which were made with a form of Aitken's pocket dust counter, showed that there are often considerable variations in the number of dust particles in a very short space of time. Not only did the dust occur in the air of inhabited countries, over the water surfaces immediately adjoining them, and up to an altitude of

6,000 or 7,000 feet amongst the Alps, but it was also found in the open ocean, and that so far away from any land as to preclude the possibility of artificial pollution, and its existence has been directly demonstrated at a height of more than 13,000 feet.

IN a letter received by the American Metric Society, G. Q. Coray, the Secretary of the Utah Metric Society, conveys the information that the metric system has been under constant agitation in Utah for nearly two years. As a result, practically every teacher, merchant and political leader is committed to the policy of adopting the system to the exclusion of all other weights and measures at as early a date as possible. The metric system has been recognized by constitutional provision, and unless Congress takes some action that will operate against the system in the near future the metric system will take the place of the old systems in the arithmetics used in the Utah public schools. The State Teachers' Association, the Legislature of Utah and the State University have forwarded memorials to Congress asking for the passage of the bill now before the House of Representatives. It is expected that the Salt Lake Chamber of Commerce will take similar action. The Utah Society proposes to send a representative to Washington to bring the merits of the system to the attention of the Congressmen. Mr. Coray states that the business men of Utah are practically a unit in favor of the movement. The Metric Society numbers over 1,000 members, and is composed largely of the business classes. The success of the Utah Metric Society naturally suggests the formation of similar societies in each of the States.

THERE will be an exhibition of horseless carriages at the Imperial Institute, London, beginning on May 9th, and at the Crystal Palace during May an exhibition will be opened for carriages of all sorts in which competitions will be arranged for horseless carriages.

THE *British Medical Journal* states that M. Duclaux, the Director of the Pasteur Institute, has made some interesting experiments on the chemical action of the sun's rays. The activity of the rays was estimated by exposing solutions of oxalic acid of known strength to their action.

The oxalic acid is converted with more or less rapidity into carbonic acid, which escapes, and at the end of the experiment the degree of acidity of the solution indicates the amount of the oxalic acid which has been decomposed, or 'burnt,' to use M. Duclaux's term. The results showed, as was to be expected, that with an overcast sky the chemical action of the sun's rays was much less than on a fine day, but beyond this they were far from concordant. With a dappled sky or with light cumulus clouds the solar combustion might be more active than with a blue sky or with a slight amount of cirrus. In a word, the apparent fineness of the body is not in any way related to its chemical activity and its hygienic power. On the whole, however, the action was greater in August than in September. This is in accordance with the experience of every photographer. As accounting partly for the discrepancies found between succeeding days both equally fine, M. Duclaux states that all essential oils and the odors sent forth into the air by vegetation diminish the actinic power of the radiations which reach the surface of the soil.

THE fourth International Congress of Criminal Anthropology will be held at Geneva, August 25-29, 1896. Application for membership should be sent to M. Maurice Bedot, Musée d'histoire naturelle, Geneva, Switzerland.

THERE has been established in Amsterdam, under the editorship of Dr. F. H. A. Peypers, a journal devoted to the history and geography of medicine.

THE Rebman Publishing Co., London, has in press a serial entitled *Archives of Clinical Skiagraphy*, edited by Dr. Sidney Rowland. The first plate will be the osseous system of a child, and five further plates, showing obscure injuries to the knee, etc., will be included in the first part.

THE *British Medical Journal* states that Dr. Edward Frankland has been asked to preside over the Toronto meeting of the British Association. It was at one time thought that the office would be accepted by the Prince of Wales, but he has decided that he would be unable to go to Canada next year.

THE *Naturwissenschaftliche Rundschau* states that the Academy of Science at Munich has awarded the Liebig gold medal to Prof. Friedr. Stohmann, of Leipzig, and the silver medals to Prof. B. Tollens, of Göttingen, and Dr. P. Soraucr, of Berlin. Prof. Tollens has also received an award of 1,000 Marks for his research on carbohydrates.

UNIVERSITY AND EDUCATIONAL NEWS.

MRS. LYDIA BRADLEY, of Peoria, Ill., has made known her intention of giving \$1,000,000 for a polytechnic institute in Peoria.

A BOSTON citizen whose name is withheld has given \$100,000 to establish a chair of comparative pathology in the medical school of Harvard University.

MRS. J. S. T. STRANAHAN, of Brooklyn, has given \$5,000 to the building fund of Barnard College.

THE Catholic University will build a dormitory costing about \$60,000 and accommodating about 50 students. It will be ready for use next October. There are at present no dormitories belonging to the universities. The University has received \$5,000 by the will of the Rev. Father Dougherty, of Honesdale, Pa.

It is expected that Mayor Strong will approve the bill authorizing the Board of Estimate and Apportionment to give the College of the City of New York \$175,000 a year instead of \$150,000, the amount it has received for several years.

OF the twenty-four fellowships annually awarded by Columbia University, the following appointments have been made in the sciences coming immediately within the scope of this journal: C. J. Keyser, *mathematics*; J. G. C. Cottier, *mechanics*; F. Schlesinger, *astronomy*; F. L. Tufts, *physics*; H. C. Sherman, *chemistry*; D. H. Newland, *geology*; P. A. Rydberg, *botany*; H. E. Crampton, Jr., and J. H. MacGregor, *zoölogy*; S. I. Franz and L. B. McWhood, *psychology*.

AT Bryn Mawr College Miss F. Cook has been appointed fellow in mathematics; Miss F. Lowwater, in physics, and Miss C. Fairbanks, in

chemistry. A fellow in biology will also be appointed.

THE University of Utrecht will celebrate this year its 260th anniversary, the *fêtes* beginning on June 22d. The many American students and professors going abroad during the summer will find this a favorable opportunity to visit Utrecht.

THE late Mrs. Nichol, of Edinburgh, has bequeathed \$10,000 to Edinburgh University, to found a scholarship in physics.

PROF. J. PERRY has been appointed to the vacant chair of mechanics and mathematics at the Royal College of Science, London.

THE University of Edinburgh has conferred the degree of LL. D., on President F. A. Walker, of the Massachusetts Institute of Technology.

THE Senate of Glasgow University has conferred the degree of LL. D., on Prof. Thiselton-Dyer and on Prof. Andrew Gray.

DR. ALBERT FLEISCHMANN has been promoted to an assistant professorship in the University of Erlangen and has been appointed director of the Zoölogical Institute. Dr. George Rörig, of the Agricultural High School at Berlin, has been appointed assistant professor of zoölogy in the University of Königsberg.

DISCUSSION AND CORRESPONDENCE.

THE MATERIAL AND THE EFFICIENT CAUSES OF EVOLUTION.

PROFESSOR BROOKS states in the last number of this journal that he is glad to find that after much irrelevant discussion one reader (M. M., *SCIENCE*, Apr. 3d) has found the thesis of his article on *Science and Poetry* (*SCIENCE*, Oct. 4, 1895) worthy of serious consideration. Now it seems to me on the contrary that M. M. does not discuss Professor Brooks' views, but simply points out the ambiguity of his phrase 'test of truth.'

I should suppose that no one outside of a madhouse would dispute Professor Brooks' view that conceivability is not a sufficient test of truth. Whether or not conceivability is a necessary condition of truth depends somewhat on what is meant by 'conceivability,' which

is a comparatively new word, and is used by Professor Brooks with some latitude. If it be inconceivable to him that the image on the retina is inverted, then of course conceivability is not for him a necessary condition of truth. Whether or not a proposition which would commonly be regarded as inconceivable—as that a straight line may enclose an area—could in a special case be proved true by evidence, and if so whether the proposition would continue to be inconceivable, are questions which M. M. does not discuss.

At the risk of again being accused of irrelevancy by Professor Brooks, neither shall I discuss these questions, but wish to make clear a distinction analogous to that pointed out by M. M. In discussions on the theory of evolution we find Neo-Darwinians saying that 'natural selection' is the cause of the origin of species, and Neo-Lamarckians saying that the environment and the movements of the animal are the causes of adaptations. Now in these cases the word 'cause' is used ambiguously, ignorance of the facts of evolution being concealed by the exhibition of ignorance of logic.

I wonder how many men of science have read Aristotle, or understand his distinctions between material, efficient, formal and final causes. We are not here concerned with a formal cause, the idea or plan of a thing, nor with a final cause, the end for which it is made; but no student of organic evolution can afford to ignore the distinction between material and efficient causes, or between the occasion and the efficient cause of an event. The material cause is that of which a thing is made, one of the occasions or necessary conditions of its existence; the efficient cause is that which produces a thing and makes it what it is. When no qualification is used *cause* should mean efficient cause or *vera causa*.

'Natural selection' is no cause of the origin of species, but may be the cause of the annihilation of unfit species. Whether or not the environment, or consciousness, or the movements of animals are causes of hereditary modifications are open questions. What is called the cause of an adaptation is, however, usually only its occasion. Thus at a recent meeting of the

New York Academy of Sciences Prof. Osborn, in arguing that the environment is one of the causes of adaptations, stated that lime is the cause of teeth, because teeth depend on the existence of lime and vary with its abundance. It is true that there could be no teeth if there were no lime, but teeth do not result from the mere presence of lime in the environment. Lime is one of the material causes and occasions of teeth, but it has not been shown that it is their efficient cause. It would seem that the environment is more often the cause of the destruction of life than the cause of its development.

J. McKEEN CATTELL.

COLUMBIA UNIVERSITY.

INSTINCT.

IN Prof. Mills' communications on 'Instinct' he seems to have missed the point in the case of each of those criticised—the 'writer of the note,' Prof. Morgan and myself. In the case of the fowl's drinking, it is not the mere fact that drinking and eating may differ in the degree to which the performance is congenital; the reports seem to show that this varies in different fowl; but that instincts (in this case drinking) may be only half congenital, and may have to be supplemented by imitation, accident, intelligence, instruction, etc., in order to act, even when the actions are so necessary to life that the creature would certainly die if the function were not performed. That is the interesting point.

Then, in criticising me, Prof. Mills accuses me of ignoring the 'effects of environment and of use.' On the contrary, these are just the facts which I appeal to. By adaptations to the environment and by use the creature manages to keep alive; other creatures die off; so certain determinate directions of congenital variation are singled out and inherited. Thus phylogenetic variations become determinate, just through these ontogenetic adaptations. This takes the place of the Lamarckian factor. Lamarckism is an 'obvious' resort in all cases, of course, but it seems to me so easy that in many cases it is shallow in the extreme.

But my view is very far from being Weismannism. I reach determinate variations by means of new functions or adaptations which

keep certain animals alive to propagate. It is really a new theory, as Prof. Osborn, who has reached about the same point of view, declares. This is also just the value which Prof. Morgan attaches to his observations.

J. MARK BALDWIN.

PRINCETON, April 17, 1896.

STUDIES IN THE MORAL DEVELOPMENT OF CHILDREN.

The Relation of the Child to Authority.

IT is desired to obtain data for a study of the attitude of young children toward parental authority, with a view to determining what sort of discipline, instruction and appeal is best calculated to develop in children a proper recognition of the parent's authority and a readiness to submit to it.

Parents who are willing to aid in the investigation are requested to carry out the following experiments, and to report the results.

1. Try different punishments for the same offence, as follows:

(a) *For Naughtiness at Table*: (1) Corporal punishment, though not necessarily severe. (2) Sending the child away from the table, with permission to return as soon as he is ready to be good. (3) Having the child eat by himself in the kitchen.

(b) *For Sauciness to Parents*: (1) Corporal punishment. (2) Sending the child into the bedroom to stay till he is ready to take back what he said. (3) Refusing to caress the child or to be caressed by him until he is ready to make up and say he is sorry. Of course, it may sometimes be hours after the offence before occasion is given for applying this last penalty, the parent meanwhile seeming to have ignored the offence. If the child has not made up before bedtime, then put him to bed without his usual kiss, explaining why you do so.

(c) *For Taking a Toy Belonging to a Playmate* (whether by force or stealth), with a resulting outcry on the part of the playmate: (1) Compelling the child by corporal punishment, or the threat of it, to return the toy to the playmate. (2) Taking the toy away by force and returning it to the playmate, and sending the child into the bedroom for five minutes. (3) Giving one of the child's favorite toys (not

at the time in his hands) to the playmate, and allowing him to keep it until the child wants an exchange badly enough to ask it of the playmate, apologizing as he does so for having taken his toy.

Remarks: (1) Try the experiments as to punishment on children from three to six and one-half years old. (2) In each case try the suggested penalties in the order given, and make two trials of each before passing to the next. (3) In no case carry the corporal punishment to the extent of 'breaking the child's will.' (4) If you object on principle to corporal punishment, state it in your record, and try the two remaining penalties in the order given.

What to Record: (1) Which of the three penalties is most effective in securing reform, and which the least so? (2) Which penalty arouses most feeling against the parent, and which the least? (3) Such actions or comments of the child during, or with reference to, the punishment as seem to you worthy of note.

II. Give commands varying in arbitrariness, as follows:

(a) Shut the door, so the room won't get cold.

(b) Carry this book into the bedroom and put in on the bed.

(c) Move that chair to the other side of the table. * * * Now move it back where it was.

(d) A double experiment. (1) Pick up these pieces of paper (a dozen pieces which you have thrown on the floor in the child's absence). (2) On another occasion throw a dozen pieces of paper on the floor while the child is looking, and request him to pick them up.

Remarks on the Above Experiment: (1) Give the commands only to children between two and one-half and four and one-half years of age. (2) Give the several commands at different times, and to each child separately. (3) Give the commands seriously—in such a way that the child will not think you are in fun. (4) Give them when the child is in good humor and behaving well, so he will have no reason to think he is being punished. (5) If the child meets any of the questions with a 'why?' say gently, but firmly, 'Because I told you to.'

What to Record: (1) In the case of what com-

mands the child asks 'why?' (2) Whether he shows surprise at any of the commands; and if so, which excite most surprise. (3) Any objections or comments the child may make. (4) How readily the several commands are obeyed, especially which are most reluctantly obeyed. (5) Whether any of the commands provoke indignation or anger in the child.

III. Effect of the manner in which commands are given.

Determine through observation and experiment: (a) What mode of giving a command secures the *quickest* obedience. (b) What mode secures the most *willing* and *cheerful* obedience.

Note especially how the child is affected by sharp and abrupt commands, as compared with the effect upon him of commands given in gentle but firm tone. (Commands may also be: direct or interrogative, *i. e.*, 'do this,' or, 'will you do this?' and with or without a 'please.')

IV. Compare the effect of Praise upon the child with the effect of Censure, as follows:

(a) *To produce in the child a love of cleanliness*—as to face, hands and dress: (1) Ignoring the occasionally clean and neat appearance of the child, make frequent disparaging remarks about his dirty face and hands, and censure him when he soils his clothes in any deliberate or careless manner. (2) Ignoring the usually more or less untidy appearance of the child, praise him warmly whenever he has washed himself (or cheerfully allowed himself to be washed) and appears *exceptionally* neat and clean.

(b) *To secure good behavior of the child during the father's absence:* (1) Let the mother in reply to the father's inquiries as to the child's conduct during his absence, relate wherein the child has been naughty, and let the father censure him for his conduct. (2) When the child has been *unusually* good, let the father, in the hearing of the child, inquire about his conduct, and when the mother has praised him warmly for his good behavior, let the father add his commendation.

Remarks: (1) Make the trial of Praise vs. Censure on children from three to six and one-half years old. (2) Give the first method of procedure a fair trial before trying the second.

What to Record: (1) Which method you find the more effective in securing the desired re-

sult. (2) The approximate number of trials made of each method before reaching your conclusion.

V. How does Pretending to Cry, on the part of the parent, affect the child: (a) As a deterrent from disobedience?

(b) In making him sorry for obedience? (Try this experiment but a few times, and only on children from two to four years old.)

VI. Observe the child's comments on hearing the following stories, and endeavor to elicit his moral judgment regarding each of the two incidents:

(a) One day a lady gave a stick of nice, red candy to a little girl, named Bessie (or to a little boy, named Robbie, if the child to whom you are telling the story is a boy). Bessie took the candy home and showed it to her mamma. Her mamma said, "How nice it looks; you must give it to me, to eat." Bessie said, "I won't! the lady gave the candy to me, and I want it myself." Then mamma took the candy away from Bessie and whipped her because she wouldn't give the candy to mamma. (Will the child see the arbitrariness of the command and of the punishment?)

(b) One day mamma gave Bessie (or Robbie) a pitcher full of milk, and told her to carry it into the pantry and put it on the shelf. Bessie walked very carefully, so as not to spill the milk; but when she came to the pantry door her little sister, Ella (or his little brother, Jamie), ran against her and made her drop the pitcher. The pitcher broke all to pieces, and the milk ran all over the floor. Then mamma scolded Bessie and sent her into the bedroom, because she broke the pitcher and spilled the milk. (Will the child see the injustice in the mother's treatment of Bessie? If so, what treatment will the child propose?)

Remarks: (1) Tell the stories to children from three to six and one-half years old. (2) Tell the two stories at different times and to each child separately. (3) In trying to elicit the child's judgment, be careful not to suggest ideas.

General Information. By way of introduction to your record of the results of the above experiments, state: (a) The child's *nationality*. (b) His *age in months* when the several experi-

ments are tried. (c) Whether he is a *normally strong* and healthy child, physically and mentally. If not, in what way he is less well or strong than the average child. (d) His *peculiarities of temperament*, especially how far he is naturally *irritable, obstinate or domineering*.

Parents who are willing to aid in the above investigation are requested to send at once to the undersigned: (a) their own names and addresses. (b) The names and respective ages (in months) of the children that are to be observed.

The information secured in response to this paper will be used in a general and statistical way, without publication of names.

It is hoped your observations may be completed, and the report of results sent in, within two, or, at most, three months after your receipt of this paper; but as much time should be taken as is necessary for accurate and full results. Address, J. F. MORSE.

WISCONSIN UNIVERSITY, MADISON, WIS.

SCIENTIFIC LITERATURE.

Frail Children of the Air. Excursions into the world of butterflies. By SAMUEL HUBBARD SCUDDER. Boston and New York, Houghton, Mifflin Co. 1895. \$1 50.

This will prove a delightful book for the coming summer season. Although its title may not be especially descriptive of the contents, the book is devoted to an account of the more interesting peculiarities in the structure, lives, and habits of our commoner butterflies. The subjects treated are the following: Butterflies in disguise, the struggle for existence in the genus *Basilarchia*, deceptive devices among caterpillars, butterflies as botanists, the names of butterflies, color-relations of chrysalids to their surroundings, the White Mountains of New Hampshire as a home for butterflies, butterfly sounds, nests and other structures made by caterpillars, postures of butterflies at rest and asleep, the eggs of butterflies, psychological peculiarities in our butterflies, social caterpillars, the fixity of habit in butterflies, how butterflies pass the winter, the oldest butterfly inhabitants of New England, protective coloring in caterpillars, aromatic butterflies, the ways of butterflies, and similar topics. Those

who are fortunate enough to possess or to have seen Dr. Scudder's great work: 'The butterflies of the eastern United States and Canada,' a work so costly as to have but a limited circulation, will recognize these chapters, which form the delightful excursions of the two volumes of text. They are charmingly written, and are mainly the result of the author's own observations, and in their present form deserve the widest reading. It would prove a beautiful present for a boy or girl interested in insects, and also afford pleasant summer reading for older minds, since few technical terms are used.

There are a number of plates containing figures reproduced from the larger work. In the matter of index, printing, paper and general appearance we not only have no fault to find, but everything to commend. A. S. P.

Third Report of the Board of Managers of the New York State Colonization Society, by O. F. COOK, Fulton Professor of Natural Sciences in Liberia College. 1896. 8°, 100 pp.

This report is a plain recital of careful observation on plants, animals, and men in the Republic of Liberia; the observations are recorded in simple, straightforward fashion, and are of considerable interest and value, albeit in an unexpected medium.

Over 30 pages are devoted to the flora and fauna; 30 or 40 plants are identified in an annotated list, and the notes touch on a variety of characteristics and uses of the plants and their products; *e. g.*, it is pointed out that the seeds of the mangrove germinate on the trees, sending out long sharp-pointed radicles, which hang pendent until the weight breaks attachments, when they drop into the mud and are thus planted right side up and so firmly as to resist tidal currents; *Urena lobata* 'is protected by ants for the sake of a secretion which is elaborated and exuded by a small gland at the base of the midvein'; the banana and bread fruit flourish, yet their products cannot be made exclusive articles of diet, as is commonly supposed, etc. There is a surprising dearth of mosses and parasitic fungi and lichens in Liberian forests, and it is noted that 'in nearly all natural groups the number of species is much larger than in the same area in North America, even

though the number of individuals may be less for the group as a whole' (page 5). There is a comforting dearth, also, of snakes, mosquitoes, flies and minor pestiferous insects, which seems to be correlated with the wealth of ants, both in species and individuals. The habits of the 'driver' ants, the natural scavengers of the district, are described in detail, as are those of the termites, which appear to cultivate a fungus to supply food for the young and the queens. It is noted that the chimpanzees (called by the natives 'old-time people') dig land crabs out of their burrows and crack them on stones,* and are said also to crack nuts between stones, 'quite man fashion,' and to grasp the python by the neck and bruise its head with a stone (page 22).

The social conditions of Liberia are described in fair detail; and it is shown that, while slavery is prohibited by the Liberian constitution, there is a modified slavery of hiring service which has degraded the servitors and still more seriously enfeebled the served, who 'rarely gain habits of industry or self-reliance, and with no proper school advantages * * * reach maturity too often as examples of physical and mental weakness' (page 45). Even more interesting is the naïve description of the 'missionary slave trade,' from which it appears that evangelization begins with actual purchase of the youth whom it is desired to Christianize and civilize! "In the interior of Liberia [slave] boys 12 and 14 years old were offered me for goods of a cash value of about \$3. Girls come at about twice the price. * * * When it comes to buying free children of their parents the price may exceed the figures mentioned" (page 40). "The only apparent reason why this department of the slave trade has not assumed proportions sufficient to attract general attention, has been the lack of funds in the hands of the would-be buyers" (page 38). In

* Major Battersby, in describing the 'Pets and Pests of the Barbadoes' (*Chambers Journal*, March 14, 1896), mentions a Capuchin monkey which captures crabs in related fashion: "His method * * * is to knock it about with his paw by quick pats until it is sufficiently dazed to give him a chance of smashing its claw with a large stone" (*Literary Digest*, Vol. XII., 1896, p. 717).

one case a missionary intending to remove to Angola was not permitted to carry her purchased pupils with her; 'thus has a negro government interfered to prevent a white missionary from taking native children 2,000 miles from their parents and kindred, in accordance with the plans of a missionary bishop' (page 43). The text contains comparatively little of ethnic interest save in scattered morsels, for, as is usual in evangelizing and civilizing enterprises, it is considered that no good thing can come from the Nazareth of the primitive; but some of the mechanically reproduced photographs illustrate the features, costume and customs of the natives, the appearance of their barricaded towns, etc., while the numerous cuts give faithful pictures of flora and landscape, and admirably supplement the simple and modest description in depicting Liberia as it is.

It is announced that the society, though retaining its original name, long since gave up its adherence to any scheme of colonization, as such, and now confines its activities to education and practical questions. A note indicates that additional copies of the report can be obtained by applying to Charles T. Geyer, Secretary, 19 William street, New York City.

W J MCGEE.

WASHINGTON, D. C.

SCIENTIFIC JOURNALS.

AMERICAN JOURNAL OF SCIENCE.

THE May number opens with an article by John Trowbridge, discussing the probable presence of carbon and oxygen in the sun. This is in the line of work earlier done (1887) by the same author in combination with C. C. Hutchins, in which they showed that the carbon bands could probably be detected in the sun's spectrum, although nearly obliterated by the overlying absorption lines of other metals, particularly those of iron. Some quantitative experiments have been now carried out by the author to show what relative proportion of iron mixed with carbon dust was required in order to produce this effect of obliterating the carbon bands. Pencils, made of carbon dust and iron (reduced by hydrogen) uniformly distributed through it, were employed. The solar spectrum near the carbon band at wave-length 3883.7 was then

photographed, also below on the same plate the pure carbon banded spectrum, and finally, immediately below this, the spectrum of the mixture of iron and carbon. It was found that from twenty-eight to thirty per cent. of iron, in combination with seventy-two or seventy per cent. of carbon, almost completely obliterated the peculiar banded spectrum of carbon. This proportion, therefore, of iron in the atmosphere of the sun, were there no other vapors of metals present, would be sufficient to prevent our seeing the full spectrum of carbon. The author then goes on to consider the case of oxygen and remarks that the question whether oxygen exists in the sun is closely related to questions in regard to the presence of carbon, when the temperature and light of the sun are considered. The regions in the solar spectrum where the bright lines of oxygen should occur if they manifest themselves have been carefully examined in order to see if any of the fine absorption lines of iron in the spectrum of iron were absent, for it is reasonable to suppose that the bright nebulous lines of oxygen would obliterate the faintest lines of iron. The result is to prove that the faintest iron lines are not obliterated in the spaces where the oxygen lines should occur.

The author concludes by remarking that, although he has not succeeded in detecting oxygen in the sun, it seems to him that the character of its light, the fact of the combustion of carbon in its mass, the conditions for the incandescence of the oxides of the rare earths which exist, would prevent the detection of oxygen in its uncombined state. Notwithstanding the negative evidence brought forward, he adds that he cannot help feeling strongly that oxygen is present in the sun and that the sun's light is due to carbon vapor in an atmosphere of oxygen.

An extended article by Harold Jacoby gives a minute mathematical discussion of the determination of the division errors of a straight scale. T. Holm gives the results of studies upon the *Cyperaceæ*, with reference to the monopodial ramification in certain North American species of *Carex*. It is shown that the monopodial character is especially well represented on this side of the Atlantic and may indeed be said to be prevalent among our sylvan forms. The article

is accompanied by a plate. W. H. Weed and L. V. Pirsson give a continuation of their paper on the Bearpaw Mountains of Montana, commenced in the April number. This is devoted to the discussion of the Beaver Creek core with reference to the massive rocks there present. These are of various types, ranging from quartz syenite and quartz syenite porphyry to basic syenite (or, as the rock has been called by Brögger, monzonite), and finally to shonkinite. It is remarked by the authors that their yogoite already described from Yogo Peak, Montana, is essentially identical with monzonite, and hence the latter name has priority.

M. Carey Lea has two brief articles. The first discusses the question of the presence of Röntgen rays in the sunlight, and decides this in the negative. A number of conclusive experiments are described, upon which this decision is based. The second article is on the numerical relation existing between the atomic weights of the elements, especially with reference to the colored and colorless character of the ions. This last subject was discussed by the same author in the *American Journal* for May, 1895, and a second paper is promised for June of this year. W. B. Clark describes minutely the Potomac River section of the Middle Atlantic Coast Eocene, showing the seventeen divisions identified in the detailed stratigraphy of the deposits as exhibited particularly between Aquia Creek, Stafford county, Virginia, and Pope's Creek, Charles county Maryland. It is concluded that the Eocene deposits of the Middle Atlantic slope constitute a single geological unit which has been described as the Pamunkey formation. The deposits are remarkably homogeneous, consisting typically of glauconitic sands and clays of a thickness of nearly 300 feet. There are two well-defined faunal zones, namely, the Aquia Creek stage and the Woodstock stage. The former approximately corresponds to the middle, or middle and upper, Lignitic, and the latter to the middle, or middle and upper, Claiborne. The author concludes by remarking that the middle Atlantic slope Eocene undoubtedly represents in a broad way all of the major part of the Lignitic, Buhrstone and Claiborne of Smith and, when the physical condition affecting range and mi-

gration of species are considered, perhaps even more. Both the geological and paleontological criteria are wholly inadequate for establishing the great number of local subdivisions recognized in the Gulf area, and in fact the sequence of forms indicates that no such differentiation of the fauna took place.

H. S. Washington describes some peculiar Ischian trachytes with special reference to certain remarkable branching forms exhibited by the feldspar phenocrysts; these are analogous to the feather-aggregates of augite which have been described in some Hawaiian basalts. For such divergent crystal forms, which are regarded as due to the ramification and growth of a single individual, and which correspond to the *sphærokrystalle* of Lehmann and Rosenbusch, the name *keratoid* (Gr. κεραυνός, a thunderbolt), is proposed. The existence of such forms has been explained by Lehmann as due to internal tensions which cause the crystals to split here and there at the surface, producing a discontinuity which cannot be overcome by further growth. The author adds the results of his own observations as modifying and extending the results of Lehmann, and concludes by considering the various types of spherulites in general. The articles close with a paper by C. Palache describing some highly modified crystals of crocoite, from a hitherto undiscovered locality in Tasmania.

AMERICAN CHEMICAL JOURNAL, APRIL.

The action of light on some Organic Acids in the presence of Uranium salts. By HENRY FAY.

After reviewing previous work on this subject the author gives the results obtained with oxalic, butyric, propionic and acetic acids. From oxalic acid he obtained carbon dioxide, carbon monoxide, formic acid and several uranium compounds. When the acids of the acetic acid series were used, equal parts of carbon dioxide and the hydrocarbon corresponding to the acid were formed. Succinic and malonic acids could not be used on account of the insolubility of the uranium compounds.

A review of some recent work on Double Halides.

By CHARLES H. HERTY.

In this paper attention is called to the char-

acter of recent work on these compounds and the apparent ignorance of published results, and a plea is made for greater care and accuracy in the preparation and analyses of these salts.

On the Quantitative Determination of Hydrogen by Means of Palladous Chloride. By E. D. CAMPBELL and E. B. HART.

The hydrogen contained in a gas mixture can be completely absorbed by a 1 per cent. solution of palladous chloride, and determined more easily that way than by explosion with oxygen.

On the Behavior of Certain Derivatives of Benzol Containing Halogens. By C. LORING JACKSON and S. CALVERT.

The presence of certain groups in a substituted benzine, containing also a halogen, makes the halogen more easily replaceable. The effect of the nitro group has been carefully studied, and in this paper the authors give the results of the influence of halogens on halogens, according to their number and position in the molecule.

The Cis and Trans Modifications of Benzine Hexabromide. By W. R. ORNDORFF and V. A. HOWELLS.

The authors have made the cis modification of benzine hexabromide, and give the results of the chemical and crystallographic study of the substance.

Silicide of Calcium. By G. DECHALMOT.

When lime, carbon and silica in excess are heated in an electric furnace, a substance of metallic appearance is formed. This is mainly silicide of calcium, with a little carbide of calcium and iron.

The Conductivity of Yttrium Sulphate. By H. C. JONES and C. R. ALLEN.

The conducting of different dilutions are given in this paper.

The Practical Use in the Chemical Laboratory of the Electric Arc Obtained from the low Potential Alternating Current. By M. S. WALKER.

The author advises the use of the electric arc in the laboratory as a partial substitute for the blowpipe, to show the effects of high temperatures on refractory substances, and for the synthetical preparation of some compounds of carbon.

The Preparation of Allylene and the Action of Magnesium on Organic Compounds. By E. H. KEISER.

When acetone is conducted over hot magnesium a black powder is formed, which decomposes when brought in contact with water. The product consisting of hydrogen and allylene is passed through an ammoniacal solution of silver nitrate, when an insoluble silver allylide is formed. The copper and mercury compounds have also been made.

The Action of Urea and Sulphocarbonyl on Certain Acid Anhydrides. By F. L. DUNLAP.

The formation of a number of complex compounds can be explained on the supposition that the reaction takes place in two stages, and the author has isolated some of the intermediate products.

There is also a review of the work on *Elektrochemie*, by W. Ostwald, and a note on *The Dilution Law of Ostwald*. J. ELLIOTT GILPIN.

THE JOURNAL OF COMPARATIVE NEUROLOGY,
MARCH.

Illustrations of Central Atrophy After Eye Injuries. By C. L. HERRICK.

This brief article is a commentary on a plate of drawings made from two series sections of the brains of rabbits whose eyes had been extirpated shortly after birth and which had been killed respectively 67 and 91 days after the operation.

Lecture Notes on Attention. An Illustration of the Employment of Neurological Analogies for Psychological Problems. By C. L. HERRICK.

Experiments are adduced which go to show that external attention is of the nature of a reflex which may or may not retain a relation of subordinated connection with conscious processes. Which particular impression may be selected out of a given sense complex for especial attention will depend upon habit mainly. All of the impressions of a given field of sense may become the content of that sense and so may exert their appropriate effects in infra-conscious spheres of association, etc., even though only part of them ever reach consciousness. The discussion as to the possible number of contemporaneous sensations is based on a

misconception. Though the content of sense may be diversified, only one thing is ever in the focus of consciousness at a given time. Attention becomes a set of rapidly repeated reproductions. In thinking intently of one thing we limit the field of oscillation and cut off distractions as much as possible, but the oscillations with the various resulting associations continue and give pregnancy to the meditation. Attention is a name for the play of consciousness, and a study of its laws reduces, on the one hand, to the investigation of neural equilibrium, and, on the other, to a natural history of consciousness. The conditions of inner attention are those of association and inhibition.

A Note on the Cerebral Fissuration of the Seal (Phoca vitulina). By PIERRE A. FISH.

The description and illustrations of this brain show that it clearly possesses the carnivorous type of fissural pattern, in spite of several complexities which tend to obscure the type.

Morphology of the Nervous System of Cypris. By C. H. TURNER.

This is the first instalment of a monograph on the Ostracoda which Prof. Turner has had in preparation for several years. It is accompanied by six plates. The ganglia and nerves of the central nervous system and the sense organs of Cypris are described with considerable minuteness. Labial, labral and thoracic nerves are described for the first time among the Ostracoda. Several new sense organs are also described.

Preliminary Notes on the Cranial Nerves of Cryptobranchus alleghaniensis. By J. H. McGREGOR.

In this paper the cranial nerves of the water dog are described, so far as they can be determined by macroscopic methods.

On Three Points in the Nervous Anatomy of Amphibians. By J. S. KINGSLEY.

This article corrects two errors in Von Pleszen and Rabinovicz's 'Die Kopfnerven von Salamandra maculata,' the one concerning the anastomosis between the ophthalmicus superficialis and the maxillary, and the other that between the ophthalmicus profundus and the palatine nerves of Salamandra. Dr. Kingsley

also points out that the tentacular apparatus recently described by Mr. Alvin Davison in Amphiuma does not exist, and therefore this point cannot be used to show the close relationship between the Cœciliidæ and the Amphiumidæ.

The remaining 44 pages of the number are devoted to abstracts and reviews.

SOCIETIES AND ACADEMIES.

THE NEW YORK ACADEMY OF SCIENCES.

THE Section of Geology and Mineralogy held its regular meeting April 20th, President J. J. Stevenson in the chair.

The first paper of the evening was by Mr. John D. Irving, on 'The Stratigraphy of the Brown's Park Beds, Utah.' The observation on which the paper was based, was made by Mr. Irving the past summer, while spending a week in Brown's Park, together with Dr. J. L. Wortman and his expedition from the American Museum of Natural History, New York. Mr. Irving first sketched the topography and geology of the Green River Basin and the Uinta Mountains. He showed the location of the Brown's Park Beds and described their unconformable position upon the Uinta sandstone and the Green River shales. He next outlined the views that had already been published regarding their stratigraphical relations, especially those of Clarence King and S. F. Emmons, of the 40th Parallel Survey, who referred them to the Pliocene, and those of C. A. White, of the United States Geological Survey, who referred them to the Eocene. Mr. Irving stated that careful search failed to reveal any fossils, except a few fragments of bone, which were in such a state that Dr. Wortman considered them to be not earlier than the Pliocene. Mr. Irving then described the Lodore cañon and explained the formation of the Lake in which the Brown Park Beds were deposited as due to the Pliocene elevation of the Uinta sandstone that forms the wall of the Lodore cañon. When this was cut down by the river the lake disappeared and depositions ceased. He, therefore, corroborated the original determinations of King and Emmons. The paper will appear in full in the Transactions.

The second paper of the evening was by

Prof. C. H. Smyth, Jr., on 'The Origin of the Talc Deposits near Gouverneur, N. Y.' Dr. Smyth first described the geological surroundings of the talc and showed that it occurs along a series of belts in limestone walls and that the previously published statement that it occurs in gneiss is incorrect. By means of microscopic sections he traced its development by the alteration of tremolite in largest part and from enstatite to a less degree, the changes in both having been affected through the agency of water and carbonic acid. The talc occurs in two forms—a scaly variety, or talc proper, and a fibrous variety or agalite. He was unable to determine whether the original rock was a basic intrusive or a siliceous magnesian limestone. The full paper will appear in the *School of Mines Quarterly* for July, 1896.

The third paper of the evening was by Prof. H. P. Cushing, and was entitled 'Are there Pre-Cambrian and Post-Ordovician Trap Dykes in the Adirondacks.' Field work in Clinton county, N. Y., had convinced the writer that there were two periods of dyke intrusion in the Adirondacks. The first yielded the porphyries or bostonite, the Camptonites and non-feldspathic dykes, which cut the Paleozoic strata up to and through the Utica slate. These dykes, are chiefly limited to the shores of Lake Champlain, both in New York and Vermont. They practically lack diabase. The second set are limited to archæan rocks, are much more numerous and are practically all diabase. One hundred and sixteen dykes in all are known in Clinton county; sixteen belong to the first series, while the remaining one hundred belong to the second. The latter have been found in the gneisses in many cases very near the contacts with the Potsdam sandstone, but in no case have they been found penetrating the sandstone. The same relations have been noted by Smyth at the Thousand Islands.

Prof. Cushing therefore urged that these dykes should be considered a separate series of rocks that had been formed subsequently to the metamorphism of the crystalline rock and before the deposition of the Potsdam sandstone. The paper will appear in full in the *Transactions*.

J. F. KEMP,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON, 259TH MEETING, SATURDAY, APRIL 4.

The first paper of the evening was Pfaff's *Recent Investigations on Rhus Poisoning*, and was presented by V. K. Chesnut. The writer briefly analyzed the work of preceding investigators and showed how the different ideas regarding the volatile nature of the poison were influenced by successive stages in the development of the science of Organic Chemistry and it was shown that nothing but an oil, like Toxicodendral, could produce the effects of poison ivy. Experiments and authentic cases of poisoning were described to corroborate Pfaff's statements that:

1. While water will not remove the oil from the skin an hour after contact, alcohol will do so very readily, especially when added in successive portions.
2. The poison is readily communicated to different parts of the body and to other persons by contact and friction.
3. The wood, as well as the leaves, is poisonous and the active principle is present in the plant at all times of the year.
4. Herbarium specimens may produce the poisonous effects.

The effect of alcohol as a palliative, and of an alcoholic solution of lead acetate as an antidote was shown by experiments made by the writer upon himself.

B. T. Galloway spoke of *the Action of Copper in Poisoning Fungi*, stating that although copper in various forms had been used for years as a fungicide, little was known in regard to the exact nature of its toxic action on plants. Most of the studies made within the past 8 or 10 years had for their object the determination of the amount of copper necessary to kill the spores of various fungi. In this connection the investigations of Nageli, and the oligodynamic phenomena described by him, were reviewed. Finally the possible methods by means of which spores of fungi may be killed or prevented from infecting living plants, were discussed and attention was called to a paper on the subject by Mr. W. T. Swingle, of the Department of Agriculture, soon to be published.

Under the title of *the Story of two Salmon*

Barton W. Evermann described the spawning habits of the Blueback and the Chinook Salmon, species which had been especially investigated by him during 1894 and 1895. These species have important spawning grounds at the headwaters of the Salmon and Payette rivers in Idaho. This paper gave an account of the manner in which the investigations were conducted and a statement of the more important results obtained.

These two species of salmon are, of course, anadromous, living in the sea, and entering fresh water only for spawning purposes. They enter the Columbia from the sea in the early spring and reach the headwaters of Salmon River over 1,000 miles from the sea, about the last week in July. The spawning began about the middle of August and continued for fully a month.

It has long been known that at spawning time these salmon have their fins more or less worn out and their bodies covered with mutilations, and these injuries were believed to have been received while on the long journey to the spawning grounds. But this was proved not to be true. More than 2,000 salmon were examined as they arrived upon the spawning beds and not one showed any mutilations of any kind.

As the spawning advanced the fish began to show mutilations; the caudal, anal and ventral fins became badly worn, and often the dorsal fin and the sides of the back were injured. By the time the spawning was at its height, scarcely a fish was wholly free from mutilations. The fish were observed daily during the entire spawning period and it was discovered that all the mutilations were received while on the spawning beds, chiefly in moving the gravel of the spawning beds about, but to some little extent in personal encounters between the males.

The second important fact determined was that, after spawning, the salmon coming to that region die, none of them ever returning to the sea. They began dying soon after they had done spawning. On September 7th 1,100 redfish or blue-back salmon were counted in the inlet to Alturas Lake. On September 16th only 213 were left, and on September 22d there were scarcely any left. None had been caught out of the

stream, but all had died. The fish showed no tendency to return down stream.

F. A. LUCAS,
Secretary.

ENTOMOLOGICAL SOCIETY OF WASHINGTON,
APRIL 11, 1896.

THE 116th regular meeting was held in Baltimore on invitation of Mr. P. R. Uhler. Mr. Howard exhibited specimens of *Margarodes vitium* Giard, from South Africa. The locality is a new one, as the species has previously been found only in Chile and Argentina. Referring to a recent note by Valery Mayet, Mr. Howard suggested that the insect is now likely to be carried to many parts of the world in any earth which may occur around exported plants. Mr. Schwartz exhibited specimens of *Coleocerus marmoratus* and an undescribed *Tychius*, to illustrate two modes of variation brought about by different position and development of the scales. In the *Coleocerus*, some specimens are uniformly covered with large white scales, which in others are replaced in spots by brown scales of smaller size. In the *Tychius* some specimens have the elytra variegated with spots and lines composed of large white scales; in other specimens the positions which should be occupied by these scales are covered with a spongy mass which a high magnifying power shows to be composed of the white scales in a collapsed or undeveloped condition. In these specimens the development of the scales has apparently been arrested. Mr. Schwarz also exhibited a new *Apion* and two species of *Anthonomus*, one new and the other *A. leucostictus* Dietz, which he had reared from the seeds of *Xanthoxylum pterota*, at San Diego, Texas.

Dr. Henry Skinner, of Philadelphia, read a paper embodying his views on specific values, and illustrated his remarks with many examples drawn from the Rhopalocera, insisting that morphological species are tentative and must be tested by a study of the life history and geographical distribution.

Mr. Ashmead read a paper on the genera *Stephanus*, *Megischus* and *Megalyra* and their position in the Hymenoptera, concluding that the family *Stephaidæ* does not deserve family rank and that the three genera should be

placed among the Braconidæ in a subfamily which he called Setphaninæ.

Mr. Uhler made some remarks on the 'schlussfeld' of certain Cicadidæ, tracing the development of this basal fold in the hind wings throughout Cicadas from many parts of the world and suggesting its connection with the rapidity of flight of the species. Mr. Benton spoke of the proposed introduction of *Apis dorsata* into the United States, giving an account of previous attempts and particularly of his own journey some years ago to Ceylon in search of this giant bee of India. He described the methods by which he secured colonies and gave an account of the habits of the bee and the character of its nests. He desired the opinion of the Society as to the possibility of the successful introduction of this bee into the United States and the desirability of such introduction. The paper was briefly discussed by Messrs. Mann, Skinner, Schwarz, Ashmead and Stiles.

L. O. HOWARD,
Secretary.

NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

At the meeting of the Section held on the 10th inst, at the College of the City of New York, Prof. Birchmore exhibited on the screen the absorption spectra of a number of aniline and other colors, including eosin, aniline red ultramarines, potassium permanganate, cudbear, etc., and explained the effect of certain reactions with ammonia and other reagents on the size and position of the absorption bands.

Dr. Birchmore also explained an arrangement of adjustable colored prisms projecting through the opposite sides of a cylinder, to be filled with a liquid having the same refractive index as glass: oil of juniper was mentioned; whereby the colors of the Nessler reagent in ammonia determinations could be recorded.

The description of this apparatus was brought out in the discussion of Dr. Albert R. Leeds' paper on 'Standard Prisms in Water Analysis, and the Valuation of Color in Potable Waters,' in which Dr. Leeds described his first attempts nearly twenty years ago to obtain suitable standards of comparison, using solutions of various kinds, colored glass plates and colored

glass prisms. He reviewed the progress which has been made in the matter, and recommended the appointment of a committee to unify the methods and adopt a standard.

Prof. C. L. Speyers read a paper on 'Matter and Energy,' in which he discussed the more recent views of Ostwald.

Dr. E. G. Love exhibited some remarkably fine microphotographs of several varieties of starch.

Dr. L. Saabach exhibited an improved form of laboratory temperature regulator, which has not only the advantage of small cost, but can be taken apart, cleaned and adjusted with the greatest ease. It may be arranged for high or low temperatures and for almost any degree of sensitiveness. It is practically an air thermometer, but can be adjusted to different degrees of sensitiveness by replacing more or less air, by mercury.

Prof. Breneman, chairman of the committee appointed to consider the organization of a chemical club, reported that he had received nearly a hundred replies to the circular sent out, all but about twenty of which were unqualifiedly in favor of the project. He stated that there had been a misunderstanding on the part of some as to the intended membership, and he desired to have it known that there is no intention of limiting the membership to any society or section of the chemical fraternity, but to include chemists and chemical manufacturers generally.

DURAND WOODMAN,
Secretary.

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY, MARCH 31, 1896.

'Longshore Transportation on the North Jersey Coast. J. EDMUND WOODMAN.

Littoral transportation is caused by wind waves, wind currents, tidal waves and tidal currents. All these factors are in active operation on the Jersey coast, but the proof is very strong that the controlling forces are tidal. The most general statement of this proof is that the winds, which must be uniform over a considerable extent of shore, act in some places in conjunction with the transportation, in others in opposition to it.

From the region east of Toms river to Sandy

Hook there is a dominant northward current; from the former place to Delaware bay a southward one. This current can be seen and traced in many places. Its geographic effect is chiefly the migration of material (and hence of inlets) from the center towards the two extremities of the State. This opposition of movement cannot be due to the fact that the northern half is in the lee of Long Island, and thus while northeast winds dominate farther south they are overpowered by southeast winds there, for at Sandy Hook or Long Branch the northeast storms are as severe as at Atlantic City.

The reason given by the U. S. C. S. (1856) for this northward movement cannot be correct; for upon examining the region we see that ever so strong a draught through False Hook channel would not cause a steady and strong current as far south as Manasquan inlet. The explanation must be sought in the effect of submarine topography upon the tides, which near shore move as waves of translation. This effect seems to be chiefly the formation of nodal points of secondary importance in the three great tidal bays of the Atlantic coast. The same phenomenon occurs on the south shore of Long Island, and on the east shore of Cape Cod. These secondary nodes are joints of divergence of currents, and must be caused by inequalities of the great continental delta which we do not now recognize.

While the author considers tidal action to be dominant here, he does not believe it to be the exclusive agent of transformation. The direction and amount depend upon the resultant of all the factors tending to produce movement, and wind waves form a very considerable element in this. But that wind waves do not control it is proved by the fact that the current continues northward against adverse winds, and can only be momentarily reversed by long continued and violent storms.

Transportation is mainly off-shore, by bar migration; but a small amount can be observed along the strand, demonstrably propelled by currents and not by waves. Most of the movement here, however, is caused by wave impact and the reflex flow of water.

The deposition is little affected by currents, for much of it is made upon the outside of Sandy

Hook, at a place where the current enters the mouth of False Hook channel, and hence is, if anything, stronger than farther south. But with a constant current deposition often varies with direction and intensity of wind.

It is worthy of note that the point of divergence of the northward and southward currents is so located that the wing, Sandy Hook, is receiving all the waste from the wearing-back of the soft headland of Cretaceous and Tertiary age which extends from Bay Head to Low Moor; while of the transportation along the barrier beaches southward none comes from the headland. Thus these beaches are only carrying their own detritus, piled up at an earlier stage, and are wasting themselves away.

T. A. JAGGAR, JR.,
Recording Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of April 20th Dr. C. M. Woodward presented the results of a study of certain statistics of school attendance, from which it appeared that the average age of withdrawal from the public schools in three cities compared was as follows: Boston, 15.8; Chicago, 14.6; St. Louis, 13.7.

Prof. J. H. Kinealy exhibited and gave a mathematical discussion of the Stang planimeter, an interesting and simple instrument of Danish invention, but improved in the United States.

WILLIAM TRELEASE,
Recording Secretary.

NEW BOOKS.

A History of the Warfare of Science with Theology in Christendom. ANDREW D. WHITE. New York, D. Appleton & Co. 1896. Vol. I., pp. xxiii+415; vol. II., pp. xxiii+474. \$5.00.

A Dictionary of Chemical Solubilities. ARTHUR MESSINGER COMEY. London and New York, Macmillan & Co. 1896. Pp. xx+515. \$5.00.

Current Superstitions. FANNY D. BERGEN. Boston and New York, published for the American Folk-Lore Society by Houghton, Mifflin & Co. 1896. Pp. x+161.

Plane and Solid Geometry. C. A. VAN VELTZER and GEORGE G. SHUTTS. Madison, Wis., Tracy, Gibbs & Co. Pp. viii+395.